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LVII—RESEARCHES ON SILENE MARITIMA AND S. VULGARIS: XX.*

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The Genetics of an Austrian Mountain Plant.

Introduction.

The breeding described in this paper involves a plant collected by the late O. Stapf, in a dry river bed, Echarn Tal bei Hallstatt, Upper Austria, 1927, at a little over 700 m. Since this plant has not yet been exactly matched with any other described species or variety it is here referred to as C.1 without any commitment as to its exact status. This can only be determined when our planned *Silene* researches are nearing completion.

In this paper the following families are analyzed :—

N. 50. C. 1 × B. 11.
N. 48. B. 11 × C. 1.
N. 41. A. 2 × C. 1.
  N. 66. N. 41 plant 7 selfed.
  N. 84. N. 41 plant 9 selfed.
N. 45. A. 15 × C.1.
  N. 63. N. 45 plant 15 selfed.
  N. 64. N. 45 plant 35 selfed.
  N. 73. N. 45 plant 31 selfed.
N. 51. C. 1 × A. 21.
  N. 77. N. 51 plant 1 selfed.
  N. 85. N. 51 plant 6 selfed.

A comparative description of C.1 follows immediately below the next paragraph. The other stock-plants used in the experiments described in this paper have been described in the following places :—

B.11, K.B. 1931, 121.
A.2, K.B. 1928, 4.
A.15, K.B. 1929, 151.
A.21, K.B. 1937, 45.

In this paper, besides the exceptional interest of studying the genetical interactions of a Central European mountain plant with British plants of *S. vulgaris* and *S. maritima*, the occurrence of coloured petals introduces a set of characters not previously described by us. The following symbols are used for flower colour :—

D (deepest) upper surface Pale Rosolane Purple (Ridgway, Pl. 26) ; lower surface Eupatorium Purple (Ridgway, Pl. 38).

* Continued from K.B. 1937, 436.

M (medium) upper surface Pale Laelia Pink (Ridgway, Pl. 38) ; lower surface Tourmaline Pink (Ridgway, Pl. 38).

P (pale) upper and lower surface very diluted Pale Laelia Pink, in the veins often Pale Laelia Pink.

D 1 upper surface Hellebore Red (Ridgway, Pl. 38) ; lower surface Deep Hellebore Red (Ridgway, Pl. 38).

M 1 upper surface Pale Laelia Pink ; lower surface diluted Eupatorium Purple.

P 1 upper surface very diluted Pale Laelia Pink ; lower surface Pale Laelia Pink, veined Tourmaline Pink.

P 2 upper surface white, lower surface tinged Pale Laelia Pink.

W both surfaces white.

Stock-plant description.

C. 1. *Habit* semi-prostrate, stems up to 3·3 dm. long, more or less ascending at the flowering ends, no barren shoots ; medium amount of anthocyanin in vegetative parts.

Leaves narrowly lanceolate, 2·1 cm. long, 0·4 cm. broad, acute, margins ciliolate, dark green.

Inflorescence of 1 to 3 flowers, flowers nodding and zygomorphic ; bracts ciliate.

Calyx ovoid cylindric in flower, becoming ellipsoid in fruit, much anthocyanin.

Corolla with the petals and segments not contiguous or overlapping ; diameter 1·3 cm. Petals 1·4 cm. long, 0·4 cm. broad, lamina bilobed, divided $\frac{3}{4}$ its length, small scale, colour M.

Androecium fully developed, flowers hermaphrodite. Filaments purple ; anthers purple.

Gynoecium with purplish stigmata and white immature seeds.

Ripe capsules obloid, without the teeth 5 mm. long, 6.5 mm. broad, mouth 4 mm. in diameter ; teeth each an isosceles triangle, 3 mm. long, 2 mm. broad at base, strongly recurved ; carpophore 2 mm. long, 2 mm. broad. The capsules are essentially of the *S. maritima* type.

Mature seeds armadillo.

Crosses involving C.1 and S. vulgaris.

N. 50. C.1 × B.11. 1 plant in the family.

Habit : more or less erect, stems up to 5·5 dm. high, medium amount of anthocyanin in vegetative parts.

Indumentum : medium.

Leaves : intermediate between the parents in shape.

Inflorescence : 9–18 flowers, slightly drooping and slightly zygomorphic.

Calyx : inflated, with much anthocyanin.

Corolla : colour P ; petals and segments not contiguous or overlapping ; petals bilobed, more than $\frac{3}{4}$; very small scale ; no blotch.

Sex : hermaphrodite.
Anthers : purple ; filaments purple.
Stigmata : purple ; immature seeds white.
Mature capsules : intermediate between the two parents.
Mature seeds : armadillo.
Completely died down in winter, with no barren shoots.

N. 48. B.11 × C.1. 1 plant in the family.
Habit : more or less erect, stems up to 4 dm. high, medium amount of anthocyanin in vegetative parts.
Indumentum : medium.
Leaves : intermediate between the parents in shape.
Inflorescence : 15 to 27 flowers, slightly drooping and slightly zygomorphic.
Calyx : inflated, with medium anthocyanin.
Corolla : colour P ; petals and segments not contiguous or overlapping ; petals bilobed, more than $\frac{3}{4}$; boss ; no blotch.
Sex : female.
Stigmata : purple ; immature seeds white.
Mature capsules : intermediate between the two parents.
Mature seeds : tubercled.
Completely died down in winter, with no barren shoots.

CROSSES INVOLVING C.1 AND S. MARITIMA.

N. 41. A.2 × C.1. 51 plants in the family.
Habit : of all plants, semi-prostrate ; stems up to 4·5 dm. long ; green with a little anthocyanin in vegetative parts ; all with some overwintering barren shoots.
Indumentum : glabrous.
Leaves : uniformly intermediate between the parents.
Inflorescence : 3 to 7 flowers, slightly drooping and slightly zygomorphic.
Calyx : in all broadly ellipsoid ; with much anthocyanin.
Corolla : colour 45 M : 6 P ; neither petals nor segments overlapping, except 9 with segments overlapping ; petals in all bilobed, except 3 with some multilobing, in all $\frac{3}{4}$ lobing ; 3 small scale : 48 scale ; 38 with blotch : 13 with no blotch.
Sex : 27 hermaphrodite : 10 hermaphrodite and female : 14 female.
Filaments : 31 purple : 6 white ; anthers 37 purple.
Stigmata : 49 purple : 2 white ; immature seeds all purple.
Mature capsules : all of *S. maritima* type.
Mature seeds : all armadillo.

N. 66. N. 41 plant 7 selfed. 13 plants in the family.
The immediate parent had P colour petals, petals and segments not contiguous or overlapping, bilobed, scale, blotch present, hermaphrodite flowers, filaments purple, stigmata purple.

Habit : of all plants, semi-prostrate ; stems up to 3 dm. long ; green with a little anthocyanin in vegetative parts.

Indumentum : glabrous.

Leaves : showing a considerable range, not scorable into classes, and no exact parental extremes, ranging from 2·5 cm. long and 0·7 cm. broad to 1·8 cm. long and 0·4 cm. broad.

Inflorescence : 1 to 4 flowers, 12 slightly drooping and slightly zygomorphic : 1 actinomorphic.

Calyx : all broadly ellipsoid ; with much anthocyanin.

Corolla : colour 1 M : 11 P : 1 W ; neither petals nor segments overlapping ; petals in all bilobed, in all $\frac{3}{4}$ lobing ; 12 small scale : 1 boss ; 12 with blotch : 1 with no blotch.

Sex : 4 hermaphrodite : 2 hermaphrodite and female : 7 female.

Filaments : 5 purple : 1 white ; anthers 6 purple.

Stigmata : 11 purple : 2 white ; immature seeds 11 purple : 2 white.

Mature capsules : all of *S. maritima* type.

Mature seeds : 8 armadillo : 4 weak armadillo.

N. 84. N. 41 plant 9 selfed. 32 plants in the family.

The immediate parent had M colour petals, petals and segments not contiguous or overlapping, bilobed, scale, blotch present, hermaphrodite flowers, filaments purple, stigmata purple.

Habit : of all plants, semi-prostrate ; stems up to 4·9 dm. long ; medium anthocyanin in vegetative parts ; with some green overwintering barren shoots.

Indumentum : glabrous.

Leaves : showing a considerable range, not scorable into classes, and no exact parental extremes, ranging from 3·2 cm. long and 0·7 cm. broad to 1·6 cm. long and 0·3 cm. broad.

Inflorescence : 1 to 4 flowers, all slightly drooping and slightly zygomorphic.

Calyx : all broadly ellipsoid ; with much anthocyanin.

Corolla : colour 15 M : 16 P : 1 W ; neither petals nor segments overlapping except in 2 where petals overlap ; 23 bilobed : 9 multilobed ; in all $\frac{3}{4}$ lobing ; all with small scale ; 29 with blotch : 3 with no blotch.

Sex : 30 hermaphrodite : 2 hermaphrodite and female.

Filaments : 31 purple : 1 white ; immature seeds 30 purple : 2 white.

Mature capsules : all of *S. maritima* type.

Mature seeds : all armadillo.

N. 45. A.15 × C.1. 40 plants in the family.

Habit : of all plants, semi-prostrate ; stems up to 4·0 dm. long ; 24 much anthocyanin in vegetative parts : 16 little anthocyanin in vegetative parts ; all with some overwintering barren shoots.

Indumentum : glabrous.

Leaves : narrow, as in A.15.

Inflorescence : 3 to 5 flowers, slightly drooping and slightly zygomorphic.

Calyx : 21 cylindric : 19 narrowly ellipsoid ; 11 light green plants with much anthocyanin in calyx : 5 light green plants with very much anthocyanin in calyx : 8 purple green plants with much anthocyanin in calyx : 16 purple green plants with very much anthocyanin in calyx.

Corolla : colour 2 D : 27 M : 11 P ; neither petals nor segments overlapping ; petals all bilobed, in all ¾ lobing ; 38 scale : 2 small scale to boss ; blotch present in all.

Sex : all hermaphrodite.

Filaments : all purple ; anthers all purple.

Stigmata : 38 purple : 2 white ; immature seeds all purple.

Mature capsules : all of *S. maritima* type.

Mature seeds : armadillo.

N. 63. N. 45 plant 15 selfed. 24 plants in the family.

Plant 15 had little anthocyanin in vegetative parts, narrowly ellipsoid calyx with very much anthocyanin, M colour of petals, scale, stigmata purple.

Habit : of all plants, semi-prostrate ; stems up to 3 dm. long ; 5 with very much : 10 with medium : 9 with little anthocyanin in vegetative parts.

Indumentum : glabrous.

Leaves : narrow.

Inflorescence : 1 to 4 flowers ; 22 slightly zygomorphic : 2 actinomorphic.

Calyx : all narrowly ellipsoid ; with much anthocyanin.

Corolla : colour 1 D : 11 M : 3 P : 9 W ; 21 petals and segments not overlapping or contiguous : 3 petals and segments overlapping or contiguous ; petals in all bilobed and in all ¾ lobing ; all bilobed ; 5 small scale : 19 scale ; all with blotch.

Sex : 17 hermaphrodite : 2 hermaphrodite and female : 5 female.

Filaments : 12 purple : 7 white ; anthers all purple.

Stigmata : 16 purple : 8 white ; immature seeds 20 purple : 3 white.

Mature capsules : all of *S. maritima* type.

Mature seeds : all armadillo.

In two plants (Nos. 15, 16) many flowers developed imperfectly, i.e., the calyx did not open, the petals did not emerge, but the stigmata projected.

N. 64. N.43 plant 35 selfed. 1 plant in the family.

Plant 35 had very much anthocyanin in vegetative parts, cylindric calyx, D colour of petals, scale, stigmata purple.

Habit: semi-prostrate; very much anthocyanin in vegetative parts.

Indumentum : glabrous.
Leaves : narrow.
Inflorescence : 1 to 4 flowers, slightly drooping and zygomorphic.
Calyx narrowly ellipsoid : with much anthocyanin.
Corolla : colour D ; neither petals nor segments overlapping ; petals bilobed, ¾ lobing ; small scale ; blotch present.
Sex : hermaphrodite.
Filaments : purple ; anthers purple.
Stigmata : purple ; immature seeds purple.
Mature capsules : of *S. maritima* type.
Mature seeds : armadillo.

N. 73. N. 45 plant 31 selfed. 7 plants in the family.
Plant 31 had little anthocyanin in vegetative parts, narrowly ellipsoid calyx, P colour of petals, scale, stigmata white.
Habit : semi-prostrate ; 1 medium anthocyanin in vegetative parts : 6 little ; stems up to 3·1 dm. long.
Indumentum : glabrous.
Leaves : narrow.
Inflorescence : 1 to 4 flowers, slightly drooping and zygomorphic.
Calyx : all narrowly ellipsoid ; 6 with much anthocyanin in calyx : 1 with very much.
Corolla : colour 5 P : 2 W ; 6 petals and segments overlapping : 1 petals and segments not overlapping ; petals bilobed, ¾ lobing ; 1 scale : 6 small scale ; blotch present in all.
Sex : 6 hermaphrodite : 1 hermaphrodite and female.
Filaments : 4 purple : 3 white ; anthers all purple.
Stigmata : 2 purple : 5 white ; immature seeds all purple.
Mature capsules : of *S. maritima* type.
Mature seeds : armadillo.

N. 51. C.1 × A.21. 7 plants in the family.
Habit : of all plants semi-prostrate ; stems up to 4·5 dm. long ; all with medium anthocyanin in vegetative parts ; overwintering green barren shoots present.
Indumentum : glabrous.
Leaves : with a slight fluctuation, intermediate between the parents, but rather verging towards A. 21.
Inflorescence : 4 to 12 flowers, on the whole the stems and plants are more floriferous than in A. 2, A. 21, C. 1, N. 41, and N. 45, very slightly drooping and very slightly zygomorphic.
Calyx : in all plants broadly ellipsoid ; with very much anthocyanin.
Corolla : colour 3 M 1 : 4 P 1 ; neither petals nor segments overlapping ; petals all bilobed, in all ¾ lobing ; 3 small scale : 4 boss ; blotch present in all.
Sex : all hermaphrodite.
Filaments : all purple ; anthers all purple.

Stigmata : 4 purple : 3 white ; immature seeds all purple.
Mature capsules : all of C.1 type.
Mature seeds : 5 tubercled.

N. 77. N.51 plant 1 selfed. 15 plants in the family.
Plant 1 had P1 petal colour, bosses, white stigmata.
Habit : semi-prostrate ; stems up to 4·5 dm. long ; medium anthocyanin in vegetative parts.
Indumentum : glabrous.
Leaves : little definite segregation, ranged from 4·2 cm. long and 0·5 cm. broad to 2·0 cm. long and 0·3 cm. broad.
Inflorescence : 3 to 7 flowers ; 9 slightly zygomorphic : 6 actinomorphic.
Calyx : 10 broadly ellipsoid : 5 ellipsoid ; all with much anthocyanin.
Corolla : colour 4 P1 : 3 P 2 : 8 W ; neither petals nor segments overlapping ; 3 multilobed : 12 bilobed, all ¾ lobing ; 9 small scale to boss : 6 boss ; 13 blotch present : 2 blotch absent.
Sex : 13 hermaphrodite : 2 hermaphrodite and female.
Filaments : 6 purple : 9 white ; anthers all purple.
Stigmata 7 purple : 8 white ; immature seeds 12 purple : 2 white.
Mature capsules : 11 as C.1 : 3 as A.21.
Mature seeds : 14 tubercled.

N. 85. N. 51 plant 6 selfed. 2 plants in the family.
Plant 6 had M 1 petal colour, small scale, purple stigmata.
Habit : semi-prostrate ; stems up to 4·7 dm. long ; medium anthocyanin in vegetative parts ; overwintering barren shoots present.
Indumentum : glabrous.
Leaves : no definite segregation to parental extremes, from 3·7 cm. long and 0·5 cm. broad to 2·5 cm. long and 0·4 cm. broad.
Inflorescence : 3 to 7 flowers ; 2 actinomorphic.
Calyx : 2 broadly ellipsoid ; 1 with much : 1 with medium anthocyanin.
Corolla : colour 1 D 1 : 1 W ; neither petals nor segments overlapping ; bilobed, ¾ lobing, blotch present ; small scale.
Sex : 2 hermaphrodite.
Filaments : 2 purple ; anthers 2 purple.
Stigmata : 2 purple ; immature seeds 1 purple : 1 white
Mature capsules : 2 as C.1.
Mature seeds : 1 tubercled : 1 armadillo.

Sterility.

Some of the families described above, and especially those involving C.1 and *S. vulgaris*, are small. In all the families described in this paper, the seed produced by the controlled crossings and selfings showed high percentage germination. When the families

were small there was low seed production, not low germination of apparently good seed. A number of pollinations were made which did not result in any seed. These were :—

N. 41 plant 1 selfed.
N. 45 plant 7 selfed.
N. 45 plant 9 selfed.
N. 50 plant 1 selfed.

Discussion.

The crosses involving C.1 and *S. vulgaris* showed a high degree of sterility and only one plant was raised from each of two reciprocal crosses. These two plants were approximately intermediate between the parents for habit, indumentum, leaf-shape, number of flowers, slightly zygomorphic flowers, calyx-shape and capsule shape. They showed characters common to both parents in no over-wintering barren shoots, bilobed $\frac{3}{4}$ lobed petals, petals and segments not overlapping or contiguous, and white immature seeds. N. 50 in having purple anthers and filaments, also agreed with both parents. N. 48 agreed with neither parent in being female. They agreed with C.1 in having a coloured corolla, and agreed with or tended towards C.1 in the amount of anthocyanin in the calyx. They showed (as between the two single-plant families) segregation for small scale and boss and for tubercled and armadillo seeds.

The crosses involving C.1 and *S. maritima* were much larger and the characters in the F_1 and F_2 families may be considered in sequence :

Habit. All the plants (98 in F_1 families, 94 in F_2 families) were semi-prostrate in habit. Slight differences in habit were not scorable into classes. All the parents had prostrate or semi-prostrate stems and no aberrant type appeared in the offspring from any cross. In all plants tested for over-wintering habit (2 year old plants) some green barren shoots persisted, at least till mid-winter. This is a *S. maritima* character.

Indumentum. All plants in both F_1 and F_2 families were glabrous, as were all the parents.

Leaf-shape. The F_1 families were approximately intermediate for this character between C.1 and the (different) *S. maritima* parents, except that in the families derived from A.15 $\times$ C.1, in which there was little constant difference between the leaf-shapes of the two parents, the F_1, on the whole, was more like the ovule parent (A.15). In the F_2 families from N. 41 there was a considerable range in leaf-shape but this was not scorable into definite classes and no parental extremes appeared in 45 plants. In the F_2 families from N. 51 there was little definite segregation and none to clearly marked parental extremes in 17 plants.

Inflorescence. On the whole the low flower number of C 1 (1–3 flowers) was slightly raised (1–3–5–7) by the introduction of *S. maritima,* most markedly in N. 51, an F_1 family with C.1 as the

ovule parent. F_1 families showed all flowers slightly nodding and slightly zygomorphic. The F_2 families gave the following figures:—

	More or less zygomorphic.	Actinomorphic.
N. 66	12 ...	1
N. 84	32 ...	0
N. 63	22 ...	2
N. 64	1 ...	0
N. 73	7 ...	0
N. 77	9 ...	6
N. 85	0 ...	2
Totals ...	83	11

Nodding and zygomorphy, on the one hand, and erectness and actinomorphy, on the other hand, are constantly associated in the *Silene* species which we are investigating genetically. In its nodding zygomorphic flowers C.1 shows a *S. vulgaris* character. In crossing typical *S. maritima* and typical *S. vulgaris,* F_1 families are approximately intermediate and the clear-cut segregation of erect actinomorphic flowers in F_2 families is rare. It is interesting, therefore, to obtain 11 actinomorphic out of a total of 94 plants in the above listed families. It should, however, be noted that 8 of these occurred in two small families when C.1 (as ovule parent) was crossed with a non-typical *S. maritima*.

Calyx. In all plants there was medium to very much anthocyanin. In calyx-shape, N. 41, and the F_2 families derived from it, and N. 51, and the F_2 families derived from it, were broadly ellipsoid, except that 5 plants in N. 77 had ellipsoid calyces (possibly fluctuations). N. 45 segregated into 21 cylindric : 19 narrowly ellipsoid, but the F_2 families were all narrowly ellipsoid. The influence of the narrow-cylindric parent, A.15 was obvious.

Corolla colour. Comparative studies forced us to recognize 8 goups forming two series from dark colour (D and D1) to white (W). The figures obtained may be set out as follows :—

	D	M	P	W
N. 41 (F_1)	0	45	6	0
N. 66 (F_2 from P) ...	0	1	11	1
N. 84 (F_2 from M) ...	0	15	16	1
N. 45 (F_1)	2	27	11	0
N. 63 (F_2 from M) ...	1	11	3	9
N. 64 (F_2 from D) ...	1	0	0	0
N. 73 (F_2 from P) ...	0	0	5	2

	D1	M1	P1	P2	W
N. 51 (F_1)	0	3	4	0	0
N. 77 (F_2 from P1) ...	0	0	4	3	8
N. 85 (F_2 from M1) ...	1	0	0	0	1

For petal colour the genic background introduced by A.2 and A.15 was essentially similar, but A.21 introduced a modification which

appeared in all the offspring with coloured flowers. It is tentatively suggested that two gene pairs are sufficient to give the colour intensities found in the two groups of families from C.1 with either A.2 or A.15, and that a modifier of these, from A.21, results in the relatively slightly different colour series in the last group of families.

Overlapping of petals and segments. Except in the small family of 7 plants in N. 73, the large majority of plants in both F_1 and F_2 families showed petals and segments not overlapping. Not overlapping is clearly dominant to overlapping. There was no overlapping in either of the original parents or in any of the F_1 or F_2 plants in the N. 51 group of families. A.15 was a rather uncertain plant for this character and was scored as " petals overlapping and the segments divergent "—i.e., it was not an extreme broad petalled plant (see Plate VII, K.B. 1929, facing p. 151). Probably this condition of the *S. maritima* parent accounts for the segregation in the F_2 families N. 63 and N. 73.

Petal lobing. Lobing was $\frac{3}{4}$ in all the F_1 and F_2 plants, even in those involving A.21, in which lobing was $\frac{2}{3}$. A few multilobed plants (i.e., plants with some petals multilobed in some, often a very few, flowers) appeared in N. 41, N. 48, and N. 77.

Coronal development. C.1 had small scales, A.2 and A.15 had well developed scales, and A.21 showed fluctuation from small scale to boss. Segregation occurred in the different families, but it is evident that some plants scored as having scales in N. 41 and N. 45 were heterozygous for this character. It is significant that no full scales appeared in the N. 51, N. 77, and N. 85 families.

Petal blotch. It is difficult to score this character in coloured flowers. The majority of the plants (all in the N. 45 series of families) had blotches, but some, even in coloured petals had no definite blotches in N. 41, N. 66, N. 84, and N. 77.

Sex. In C.1, A.15, and A.21 only hermaphrodite flowers were observed; A.2 had mainly female, with a few hermaphrodite, flowers. The larger number of female and hermaphrodite-female plants in N. 41, and the F_2 families from it, is in accord with expectations.

Anthocyanin development in androecium and gynoecium.

	Filaments		Anthers		Stigmata		Immature seeds	
	P	W.	P.	W.	P.	W.	P.	W.
N. 41	31	6	37	0	49	2	51	0
N. 66 ...	5	1	6	0	11	2	11	2
N. 84 ...	31	1	32	0	31	1	30	2
N. 45	40	0	40	0	38	2	40	0
N. 63 ...	12	7	19	0	16	8	20	3
N. 64 ...	1	0	1	0	1	0	1	0
N. 73 ...	4	3	7	0	2	5	7	0
N. 51	7	0	7	0	4	3	7	0
N. 77 ...	6	9	15	0	7	8	12	2
N. 85 ...	2	0	2	0	2	0	1	1

Purple anthers alone occur all through the families. Where segregation occurs for colour of filaments, stigmata, or immature seeds, the larger number of plants is for the presence of colour in the respective organ, except: in N. 73 for stigmata (from an immediate parent with white stigmata); in N. 77 for filaments, and stigmata (from an immediate parent with purple filaments and white stigmata); and in N. 85, for immature seeds, where the numbers are too low to have much more significance than showing that segregation occurs.

Anthocyanin inheritance in flower parts has been discussed in several previous papers in this series (notably in K.B. 1932, 234 seq. and K.B. 1934, 386 seq.). It is intended to summarize the results in a later part.

Capsule type. C.1 (like certain other Central European high mountain plants of this group) had capsules of the *S. maritima* type—an important fact in considering the phylogeny of *S. vulgaris* and *S. maritima*. A.2 and A.15 were typical *S. maritima* in capsule characters. F_1 and F_2 families involving C.1, A.2, and A.15 had all *S. maritima* capsules. A. 21 had capsules of "an exaggerated *maritima* type" (K.B. 1937, 46). The ordinary *S. maritima* type was dominant in F_1 over the "exaggerated" type, but 3 of the latter segregated from 14 plants in N. 77.

Mature seeds. In N. 41 and N. 45 and the F_2 families derived from them only plants with armadillo seeds appeared. This was expected as C.1, A.2, and A.15 had armadillo seeds, a character previously known to be recessive to tubercled. The only aberrant result was the occurrence of 4 modified armadillo plants (termed "weak armadillo") in N.66.

A. 21 was strongly tubercled and only plants with tubercled seeds appeared in F_1 and in N. 77. A segregation for armadillo appeared in N. 85. These results can be satisfactorily interpreted on the basis of "tubercled" (including "strongly tubercled") being dominant over armadillo.

Summary.

The results are given of crossing a plant from the Eastern Alps with British stocks of *S. vulgaris* and *S. maritima*, including a mountain plant of the latter from Wales. Considerable sterility was shown by some of the crosses and selfings—especially when *S. vulgaris* was used as the second parent. C.1 is a representative of high mountain Central European plants, which, while classifiable under *S. vulgaris* s. l. for such characters as zygomorphic, nodding flowers, and the frequent occurrence, though not in C.1, of indumentum, recall *S. maritima* in having few flowered inflorescences and squat capsules with reflexing teeth. Other characters often parallel with those of *S. maritima* are the leaf-shape and the high percentage occurrence in the wild of armadillo seeds. Since other high mountain plants are in process of being analyzed genetically,

a consideration of the taxonomic importance of the results is reserved till the experiments are completed. On the whole the introduction of C.1 did not result in greater complexity of segregation than when British material alone has been used. Even coloured petals appear in some wild populations of British *S. vulgaris* (e.g., Loch Tay shore and Plymouth Hoe). Most of the characters behaved genetically according to expectations derived from previous investigations.

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LVIII—NOTES ON MESEMBRYANTHEMEAE: I.

THE GENUS BROWNANTHUS SCHWANTES. A. A. Bullock.

The generic name *Brownanthus* was coined by Schwantes (5) for N. E. Brown's genus of *Mesembryanthemeae* which the latter had named *Trichocyclus* (1). This name, although aptly descriptive of the ring of deflexed hairs around the base of each pair of leaves, cannot be used for the genus on account of the existence of the name *Trichocyclus* Dulac (3). In his *Flore des Hautes-Pyrénées*, Dulac made new names for all genera which had been named after persons, a procedure to which he objected, and the well known name of the genus of ferns, *Woodsia* R. Br., was illegitimately changed by him to *Trichocyclus*. Thus, although *Trichocyclus* Dulac was an illegitimate name, it was validly published by reference to *Woodsia* R. Br., and it is this fact which, in accordance with the International Rules, Art. 61, renders necessary the rejection of the name *Trichocyclus* N. E. Br. as a later homonym.

It must be admitted that, on account of some ambiguity in the wording of the rules then in force, Brown was in some measure justified in his argument for maintaining *Trichocyclus* N. E. Br. (2), but the latest edition of the rules, approved by the Botanical Congress of 1935, leaves no doubt that only validity of publication is to be considered in cases of this nature.

As far as I have been able to ascertain, Schwantes has never replied to Brown's article rejecting *Brownanthus*, and this name has never received recognition.

The articles by Maass (4), which include a key to the five species recognised by Brown, should have appeared under Brown's name alone, as they are, in effect, translations of notes supplied by Brown, and now deposited in the Kew Herbarium.

A new key to the five species is given below, and an enumeration including all the synonymy and references to the literature that I have been able to collect. The notes following the citations of herbarium specimens are taken partly from the late Dr. Brown's manuscript, and partly from a consideration of the literature and specimens. I have deferred giving detailed descriptions of the species until living material of at least some of them becomes available.

Brownanthus *Schwantes* in Zeitschr. Sukkulentenk. **3,** 14 (in clavi) et 20 (1927).

Trichocyclus N.E. Br. in Bothalia, **1,** 151 (1923), et in Gard. Chron. Ser. 3, **78,** 433 (1925), in clavi, et in Phillips, Gen. S. Afr. Fl. Pl. 248 (1926), et in Journ. Bot. **66,** 267 (1928) in obs.; Maass in Zeitschr. Sukkulentenk. **3,** 233 et 322 (1928); von Poelln. in Fedde. Repert. **32,** 70 (1933); Jacobsen, Die Sukkulenten, 181, f. 188 (1933), et Succ. Pl. 251, f. 239 (1935)*; Pax et Hoffm. in Engl. et Prantl, Natürl. Pflanzenfam. 2 Aufl. **16** C, 220 (1934); non Dulac, Fl. Hautes-Pyrén. 31 (1867).

CLAVIS SPECIERUM

Folia elongata, subcylindrica vel leviter applanata; annulus pilorum deflexorum semper conspicuus; internodia ramorum haud clavata:

Papillae foliorum in setam mollem non desinentes:

Rami erecti multiramosi.....1. *B. ciliatus*

Rami erecti simplices.....2. *B. simplex*

Papillae foliorum omnes in setam mollem desinentes 3. *B. pubescens*

Folia deltoidea; rami erecti ramosi, internodiis crasse clavatis:

Annulus pilorum deflexorum conspicuus.....4. *B. Marlothii*

Annulus pilorum deflexorum inconspicuus, sed vaginae foliorum infra basin in cupulam scariosam inversam productae 5. *B. namibensis*

1. **Brownanthus ciliatus** (*Ait.*) *Schwantes* in Zeitschr. Sukkulentenk. **3,** 21 (1927).

Mesembryanthemum ciliatum Ait. Hort. Kew. ed. I. **2,** 179 (1789); Thunb. in Nov. Act. Car. Leop. Ephem. **8,** App. 11 (1791), et Fl. Cap. ed. Schultes, 416 (1823); Haw. Obs. Mesembr. 363 (1794); Sond. in Harv. et Sond. Fl. Cap. **2,** 436 (1861–62); L. Bolus in Ann. S. Afr. Mus. **9,** 147 (1913).

Mesembryanthemum Schenckii Schinz in Bull. Herb. Boiss. **5,** App. 3, 80 (1897); Dinter, Neue und wenig bekannte Pflanzen Deutsch-Südwest-Afrikas, 43, f. 57 (1914), et in Fedde, Repert. **19,** 192 (1923).

Trichocyclus ciliatus (Ait.) N.E. Br. in Bothalia, **1,** 151 (1923), et in Phillips, Gen. S. Afr. Fl. Pl. 248 (1926), et in Journ. Bot. **66,** 267 (1928), et in Brown, Tisch. et Karst. ed. Labarre, Mesembryanthema, 296, f. 166 (1931); Maass in Zeitschr. Sukkulentenk. **3,** 234, cum fig. (1928), et l.c. 322, in clavi; Jacobsen, Die Sukkulenten, 182, f. 188 (1933), et Succ. Pl. 251, f. 239 (1935).

Brownanthus Schenckii (Schinz) Schwantes in Zeitschr. Sukkulentenk. **3,** 21 (1927).

SOUTH-WEST AFRICA. Aus, *Dinter* 1150; ibid., *Schenck* 174 (type collection of *M. Schenckii*); ibid., "common", *Pearson* 8057; Garub, 900 m., *Dinter* 1048.

* This is the improved English edition, translated by Mrs. V. Higgins.

South Africa. Kenhart Div.: Pofadder, *Vanzyl* (ex herb. N.E. Br.). Calvinia Div.: on red sand about 8 miles S.-W. of Bitterfontein, *Pearson* 3941*. Van Rhynsdorp Div.: karoo between Oliphants R. and the Bokkeveld, *Thunberg* (type, not seen). Ceres Div.: karoo between Gansfontein and Pappekuil, 300 m., *Pearson* 3687—" spreading bush with prostrate branches, flowers white." Laingsburg Div.: Rietvlei, *Muir* 4215. Prince Albert Div.: karoo, without precise locality, *van der Bijl* 64—" plants lie flat on the ground, covered with flowers." Uniondale Div.: karoo, 13 miles from Uniondale, on the road to Willowmore, 720 m., growing in shale, *Fourcade* 4284.

This is the type-species of the generic name, and, as indicated above, it occurs over an immense area, from southern South-West Africa in the north to the Uniondale Division of South Africa in the south. Some of the specimens from South-West Africa approach *T. simplex* in being less branched than specimens from areas nearer to the *locus classicus*, but the branching probably varies according to environmental conditions. Dr. J. Muir (in litt. 28. xii. 1927) sent cuttings grown by him to Dr. Brown, showing internodes on a young growth four times as long as those on the old stems.

As far as can be ascertained, *B. ciliatus* is the only species of the genus in cultivation in Europe, and the illustration cited above is from a photograph of a plant in the collection of M. de Laet. According to Aiton, it was introduced by Masson in 1774.

2. **Brownanthus simplex** (*N. E. Br. ex Maass*) *Bullock*, comb. nov.

Trichocyclus simplex N.E. Br. ex Maass in Zeitschr. Sukkulentenk. **2,** 234 (1928), nomen, et l.c. 322, in clavi; N.E. Br. in Brown, Tisch. et Karst. ed. Labarre, Mesembryanthema, 297 (1931), in obs., Jacobsen, Die Sukkulenten, 182 (1933), et Succ. Pl. 252 (1935).

South-West Africa. Lüderitz District: stony ground between Klein Karas and Nakies, *Pearson* 8067 (type)—" bush 1 ft. high, flowers white."

This specimen consists of a single (presumably) horizontal branch, bearing several erect flowering shoots up to about 4 inches long, unbranched, and bearing one or two terminal, almost sessile, flowers. The leaf-sheaths are half to three-quarters of the length of the internodes, and the ends of the deflexed hairs are covered by the sheath next below them, the remaining parts forming a silky covering of the exposed part of the stem.

This may be only a form of *B. ciliatus*, but the single specimen presents a somewhat different facies, and until more material becomes available, it is impossible to reach a decision.

* A manuscript note by the late Dr. N. E. Brown says, "Matches the type of *M. ciliatum* Thbg., in Thunberg's Herb.! Comp. Jan. 24, 1922."

3. **Brownanthus pubescens** (*N. E. Br. ex Maass*) *Bullock*, comb. nov.

Trichocyclus pubescens N.E. Br. ex Maass in Zeitschr. Sukkulentenk. **3,** 234 (1928) nomen, et l.c. 322, in clavi.

Trichocyclus buchubergensis Dinter, Pl. Exsicc. No. 6485, et in Fedde, Repert. **29,** 169 (1931), nomen, in obs.

Trichocyclus Pillansii L. Bolus, Notes Mesembr. **2,** 311 (1932).

South-West Africa. Lüderitz District: flats east of the Bukhu Mts., *Dinter* 6485 (type collection of *T. buchubergensis*).

South Africa. Little Namaqualand: Richtersveld, abundant on old river terraces on south side of Orange R., between Arris Drift and Swartwater, *Pillans* 5706*; between Arris Drift and Arris, *Pillans* 5042*; Sendling's Drift, *Herre* (Stellenbosch University Garden 8758*); between Verleptpraam (Roode Kop?) and the mouth of the Orange R., *Drège* 2937 (type).

The type specimen consists of a single young stem, and the pubescence is due to the fact that each of the leaf-papillae is produced into a long soft hair. In the dried state, the papillae themselves collapse, and are not easy to see.

As in *B. namibensis*, the annulus of deflexed hairs in this species is not so prominent as in *B. ciliatus*, but the leaf-sheaths are produced below the leaf base into a shallow scarious inverted cupule encircling the stem. In this species, and in *B. Marlothii*, the leaf-bases are swollen, and the plants present a jointed or "salicornioid" appearance.

Dr. Bolus states that *T. Pillansii* flowered in Mr. Pillans' garden in February, 1927 and at Stellenbosch in December, 1931. Presumably her description was drawn up partly from living plants and partly from dried material, and it is therefore difficult to fix a type for the name *T. Pillansii*.

4. **Brownanthus Marlothii** (*Pax*) *Schwantes* in Zeitschr. Sukkulentenk. **3,** 21 (1927).

Mesembryanthemum Marlothii Pax in Engl. Bot. Jahrb. **10,** 13 (1889); Schinz in Bull. Herb. Boiss. **5,** App. 3, 80 (1897); Marl. in Trans. Roy. Soc. S. Afr. **2,** 34 (1910); Dinter in Fedde, Repert. **19,** 190 (1923), et l.c. **29**, 163 (1931).

Trichocyclus Marlothii (Pax) N.E. Br. in Journ. Bot. **66,** 267 (1928), et in Brown, Tisch. et Karst. ed. Labarre, Mesembryanthema, 297 (1931), in obs.; Maass in Zeitschr. Sukkulentenk. **3,** 234 (1928), et l.c. 322, in clavi; Jacobsen, Die Sukkulenten, 182 (1933), et Succ. Pl. 252 (1935).

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* These specimens are cited by Dr. Bolus under her *Trichocyclus Pillansii*. I have not seen any of them, but the description leaves no doubt that they belong here.

Mesembryanthemum solutifolium Berger in Engl. Bot. Jahrb. **57,** 631 (1922).

South-West Africa. Lüderitz District: in stony places near Angra Pequena, *Marloth* 1149 (fragment of the type collection in Kew Herb.); ibid., *Schinz* 922; ibid., *Moss* 11562; Lüderitz Bay (= Angra Pequena), *Dinter* 1008 (type collection of *Mesembr. solutifolium*); ibid., received by N. E. Brown from Mrs. E. Sexton, collector unknown; Pomona, *Dinter* 6419; Kohlmann's Koppe, 150 m., frequent in stony places, *Engler* 6802—"large cushions up to 1 m. diam. and 10–15 cm. high."

South Africa. Little Namaqualand: high river terrace near mouth of Orange River, *Pillans* 5146.

The jointed or "salicornioid" appearance of the stems in *B. Marlothii* has been referred to under the preceding species. This is, however, much more pronounced in *B. Marlothii*. The swollen leaf-base forms a shallow cup, the small deltoid lamina being eventually detached by an abscission on its rim. The annulus of deflexed hairs is at first prominent, but later becomes reduced to a white line around the base of the leaf-sheath.

5. **Brownanthus namibensis** (*Marl.*) *Bullock*, comb. nov.

Trichocyclus namibensis (Marl.) N.E. Br. ex Maass in Zeitschr. Sukkulentenk. **3,** 234 (1928), nomen, et l.c. 322, in clavi; Jacobsen, Succ. Pl. 252 (1935).

Mesembryanthemum namibense Marl. in Trans. Roy. Soc. S. Afr. **2,** 35 (1910); Dinter in Fedde, Repert. **29,** 163 (1931).

South-West Africa. Lüderitz District: in stony places near Lüderitz Bay, *Marloth* 4610 (type collection); ibid., *Moss* 11656; ibid., *Dinter* 6002.

This is in some respects intermediate between *B. Marlothii* and *B. ciliatus*. The leaves, while still deltoid in shape are longer than in *B. Marlothii*, and on withering or drying they become weakly spinescent before falling. The annulus of deflexed hairs is here very short, but the leaf sheath is conspicuously prolonged downwards into an inverted scarious cup. This effect would be produced in other species if the hairs became united.

References.

1. Brown, N. E. "The genera Aloë and Mesembryanthemum as represented in Thunberg's Herbarium: Trichocyclus" in *Bothalia*, **1,** 151 (1923).
2. Brown, N. E. "Mesembryanthemum and allied genera: Brownanthus" in *Journ. Bot.* **66,** 267 (1928).

3. Dulac, J. "*Flore du Département des Hautes Pyrénées,*" 31 (1867).
4. Maass, C. A. "Mesembryanthemum. Genus: *Trichocyclus* N. E. Br." in *Zeitschr. fur Sukkulentenkunde,* **3,** 233, 322 (1928).
5. Schwantes, G. "Zur Systematik der Mesembrianthemen: Schlüssel" in *Zeitschr. fur Sukkulentenkunde,* **3,** 14, 20 (1927).

LIX—NOTES ON THE GENUS CENTAURIUM.

1. The Nomenclature of the British Species. J. S. L. Gilmour.

The Generic Name.

Linnaeus (Sp. Pl. 229 : 1753) united the centauries with the gentians and other genera under the name *Gentiana.* The first subsequent author to separate them was Hill (Brit. Herb. 62 : 1756), who revived the name *Centaurium* which had been used by Dodoens, Caspar Bauhin and others. Hill, however, included both *Chlora* and *Cicendia* under the name *Centaurium.* This concept was amended by Adanson (Fam. Pl. **2,** 507 : 1763), who confined the name to the centauries. Unless, therefore, Hill's and Adanson's works are rejected by international agreement, the valid name for the genus is *Centaurium* Hill, emend. Adanson (see Druce in Naturalist, 1926, 115).

List of British Species and Hybrids, with Important Synonyms and Notes.

In the following list, where varieties are enumerated, these are not intended as fully representative of the intraspecific variation in Britain of the species concerned; they are included since the specific names adopted necessitate in some cases new varietal combinations, and it is convenient to have these collected in one place. In each case a varietal name has been given to that portion of the species usually regarded as "typical," as this seems more logical than to leave one portion designated by the specific name only.

1. **Centaurium umbellatum** *Gilib.* Fl. Lith. **1,** 35 (1785).—*Gentiana Centaurium* L. Sp. Pl. 229 (1753), excl. vars. β & γ. *Chironia Centaurium* Curt. Fl. Lond. fasc 4, t.22 (1798). *Centaurium vulgare* Rafn, Danm. Fl. **2,** 73 (1800). *C. Erythraea* Rafn, op. cit. 75. *Erythraea Centaurium* Pers. Syn. 283 (1805).

Varieties.

a. Var. **Centaurium** (*L.*) *Gilmour,* stat. nov.—*Gentiana Centaurium* L. l.c., excl. vars β & γ.

b. Var. **fasciculare** (*Duby*) *Gilmour,* comb. nov.—*Chironia* Centaurium var. fascicularis Duby in De Candolle, Bot. Gall. **1,** 328 (1828). *Erythraea Centaurium* var. *conferta* Wheld. et Salm. in Journ. Bot. 1925, 345.

c. Var. **subcapitatum** (*Corb.*) *Gilmour,* comb. nov.—*Erythraea Centaurium* var. *subcapitata* Corb. Nouv. Fl. Norm. 392 (1893).

E. Centaurium var. *capitata* Koch sec Wheld. et Salm. in Journ. Bot. 1925, 345, et auct., non Koch, Syn. 492 (1837).

d. Var. **sublitorale** (*Wheld. et Salm.*) *Druce,* in Naturalist, 1926, 115.—*Erythraea Centaurium* Pers. var. *sublitoralis* Wheld et Salm. l.c.

Hybrids.

X **C. Wheldonianum** *Druce,* Brit. Pl. List, 78 (1928).
(*C. pulchellum* x *umbellatum*).

X **C. intermedium** *Druce,* Brit. Pl. List, 78 (1928).
(*C. littorale* x *umbellatum*).

The forms of this variable species are very numerous and run into one another. Four main groups can perhaps be distinguished and the earliest varietal names for these appear to be as given above. The treatment of var. *capitata* Koch is explained in the notes under the next species.

2. **C. capitatum** (*Willd.* ex *Cham.*) *Britten et Rendle,* List Brit. Seed Pl. 20 (1907).—*Erythraea capitata* Willd. ex Cham. Adnot. ad Fl. Berol. 9 (1815). *E. Centaurium* β *capitata* Koch, Syn. 492 (1837).

The history of this interesting species is fully discussed by Townsend in Journ. Linn. Soc. **18,** 402 (1881). One further point may be mentioned. *Erythraea Centaurium* β *capitata* Koch, l.c., has always been treated as distinct from Willdenow's *E. capitata,* and has been regarded as a dwarf variety of *C. umbellatum* (see, for example, Wheld. & Salm. in Journ. Bot. 1925, 345). In Koch's original description, however, he cites Willdenow's plant as a synonym and it is clear that he was merely reducing the status of the latter's species to that of a variety.

3. **C. littorale** (*Turner*) *Gilmour,* comb. nov.—*Chironia littoralis* Turner, in Turner et Dillwyn, Bot. Guide, 469 (1805); Smith, Eng. Bot. **33,** t.2305 (1812). *Ch. uliginosa* Wald. et Kit. Pl. Rar. Hung. **3,** 287, t.259 (1809 or 1810)*. *Erythraea compressa* Hayne ex Kunth, Fl. Berol. 65 (1813). *E. littoralis* Fries, Novit. Fl. Suec. 29

* I am indebted to Mr. W. T. Stearn for the following bibliographical note :—

Although the title-page of volume 3 of Waldstein and Kitaibel's " Descriptiones et Icones Plantarum rariorum Hungariae " (folio : Vienna) is dated 1812, contemporary references show that its publication in parts spread over several years. Each part contained 10 plates and 2 or 3 sheets of text. Parts 21–22 (*i.e.*, Vol. 3, parts 1–2), containing plates 201–220, were issued in 1807 : cf. Bot. Zeit. (Regensburg) **6,** 325 (14 Nov. 1807), Hinrichs', Verz. neu. Büch. Jan.–Juny 1807, p. 108. Parts 25–26, which can safely be assumed to have contained plates 241–260, were first offered for sale by the Leipzig bookseller, J. C. Hinrichs, in his half-yearly catalogue of new publications available during January to June 1810 (Verz. Jan.–Juny 1810, p. 144), but this does not exclude the possibility that they had been published at Vienna late in 1809 and reached Leipzig too late for inclusion in Hinrichs' Verz. July-Dec. 1809. The date of publication of *Chironia uliginosa* Waldst. et Kit. (op. cit. 3, t. 259) would accordingly appear to be late in 1809 or early in 1810.

(1814). *E. linariifolia* Pers. sec. Koch, Syn. 492 (1837) et auctt., non Pers. Syn. **1,** 293 (1805). *E. Turneri* Wheld. et Salm. in Journ. Bot. 1925, 347.

Varieties.

a. Var. **littorale** (*Turner*) *Gilmour*, comb. nov.—*Chironia littoralis* Turner, l.c. *Erythraea vulgaris* var. *littoralis* Wittr. Bot. Not. 1884, 115. *E. Turneri* Wheld. et Salm. l.c.

b. Var. **occidentale** (*Wheld. et Salm.*) *Gilmour*, comb. nov.—*E. compressa* Hayne var. *occidentalis* Wheld. et Salm. in Journ. Bot. 1925, 349.

c. Var. **Bayleyi** (*Wheld. et Salm.*) *Gilmour*, comb. nov.—*Erythraea compressa* Hayne var. *Bayleyi* Wheld. et Salm. Journ. Bot. 1925, 350.

d. Var. **minor** (*Hartm.*) *Gilmour*, comb. nov.—*E. compressa* Hayne var. *Friesii* forma *minor* Wheld. et Salm. in Journ. Bot. 1925, 349.

The nomenclature of the narrow-leaved N. European centauries has been much confused, due partly to taxonomic difficulties and partly to misidentifications.

With regard to the former, the point at issue is whether the small form first described from Northumberland and Elgin by Turner (l.c.) as *Chironia littoralis*, is specifically distinct from the larger and more widely distributed form first described by Hayne (l.c.) as *Erythraea compressa*. The majority of authors have regarded these forms as conspecific, but Wheldon and Salmon (l.c.) described Turner's form as a separate species under the name *Erythraea Turneri*. A study of the variation in these narrow-leaved forms, many of which I have grown from seed in cultivation (see also Melderis, in Act. Hort. Bot. Univ. Latv. **6,** 123 : 1932) shows clearly that there exists a large number of genetically distinct forms as worthy of specific rank as *E. Turneri*, and it seems wisest to treat them all as one variable species. It is on this taxonomic judgment that the following nomenclatural notes are based.

In the Linnean Herbarium both *C. umbellatum* and *C. littorale* are included under the name *Gentiana Centaurium*, so it is evident that Linnaeus did not consider them distinct. Apparently the first botanists to separate them were Winch and Brodie, at the beginning of the last century. They considered that the small form from N. Britain referred to above should be regarded as a species distinct from the common centaury (*C. umbellatum*). They communicated their views to Dawson Turner who, somewhat reluctantly, described it under the specific name *Chironia littoralis* (Turner & Dillwyn, l.c. : 1805). This name was taken up in " English Botany " (l.c.) by Smith in 1812 and also, two years later, by Fries (l.c.).

Meanwhile Waldstein and Kitaibel (l.c.) in 1809 or 1810, and Hayne (l.c.) in 1813, independently described narrow-leaved centauries under the names *Chironia uliginosa* (from Hungary) and

Erythraea compressa (from near Berlin) respectively. Further, in addition to these names, three others must be taken into consideration, namely *Centaurium vulgare* Rafn (Danm. Fl. **2,** 73 : 1800), *C. Erythraea* Rafn (op. cit. 75), and *Erythraea linariifolia* Pers. (l.c. 1805). These five names may be discussed in turn.

(1) *Chironia uliginosa* Wald. et Kit. This interesting E. European inland form is now regarded as only varietally distinct from the coastal forms. It is mentioned here because, if Turner's *Chironia littoralis* be accepted as a distinct species, then *uliginosa* is the earliest epithet for the remainder of the group, as it antedates *compressa* by three or four years.

(2) *Erythraea compressa* Hayne. This name has been used by several authors, either because they regarded Turner's plant as a distinct species (*e.g.* Wheldon and Salmon, l.c., and Butcher and Strudwick, Further Illust, Brit. Pl. 236 : 1930), or because they appear to have ignored the earlier names (*e.g.*, Rouy & Foucaud, Fl. France, **20,** 240 : 1908).

If Turner's plant be accepted as only varietally distinct then *E. compressa* becomes a synonym.

(3) *Centaurium vulgare* Rafn. This name was first applied to the narrow-leaved centauries by Wittrock (in Bot. Centralbl. **19,** 59 : 1884). A study of the original Danish description (for a translation of which I am indebted to Mr. H. Gilbert-Carter) shows beyond doubt that Rafn had *C. umbellatum* in mind when he drew it up. In not a single particular does the description resemble *C. littorale*, and the figure cited from the " Flora Danica " is a good representation of *C. umbellatum*. It is a mystery how Wittrock could have made this error, which many subsequent botanists have copied.

(4) *Centaurium Erythraea* Rafn. It is even more puzzling why this name has been applied to *C. littorale* (*e.g.*, by Raunkiaer, Dansk Ekok. Fl. 260 : 1914). Rafn's original description (Danm. Fl. **2,** 75 : 1800) is of a tall, broad-leaved form of *C. umbellatum*. He compares it with a plant from Tangier and concludes that they are identical. It clearly has no connexion with *C. littorale*.

(5) *Erythraea linariifolia* Pers. This name has been frequently used for *C. littorale*, but, as was shown by Rouy & Foucaud (Fl. France, **10,** 240 : 1908), the plant described by Persoon is a distinct species from Spain.

The earliest name under *Centaurium*, therefore, for the northern, narrow-leaved centauries is *C. littorale*. This combination does not appear to have been made, and it is accordingly published here, together with certain new varietal combinations.

4. **C. pulchellum** (*Swartz*) *Druce*, Fl. Berks. 342 (1897)—*Gentiana Centaurium* var. β et γ Linn. Sp. Pl. 230 (1753). *G. pulchella* Swartz in Vet. Acad. Handl. Stockh. 1783 : 84. *Erythraea ramosissima* Pers. Syn. **1,** 283 (1805).

Varieties.

a. Var. **palustre** (*Gaud.*) *Druce*, in Rep. B.E.C. 1922, 615 (1923). —*Gentiana pulchella* Swartz, l.c. *Erythraea pulchella* var. *palustris* Gaud. Fl. Helv. **2**, 137 (1828). *Erythraea pulchella* subsp. *simplicissima* Schmitt in Linnaea, **7**, 482 (1832). *E. ramosissima* β *pulchella* Griseb. ex DC. Prod. **9**, 57 (1845). *E. pulchella* forma *Swartiana* Wittr. in Bot. Not. 1899, 272.

b. Var. **ramosissimum** (*Gaud.*) *Gilmour*, comb. nov.—*Gentiana palustris* Lamk. Tabl. Encycl. **1**, 486 (1791). *Erythraea ramosissima* Pers. l.c. *E. pulchella* var. *ramosissima* Gaud Fl. Helv. **2**. 137 (1828). *E. ramosissima* var. *genuina* Rouy et Foucaud, Fl. Fr. **10**, 243 (1908).

c. Var. **intermedium** (*Mérat*) *Gilmour*, comb. nov.—*Chironia intermedia* Mérat, Fl. Env. de Paris, ed. 2, pt. 2, p. 145 (1821). *Erythraea ramosissima* var. *intermedia* Rouy et Foucaud, l.c. [Druce, Brit. Pl. List, 79 (1928), uses the name var. *subelongatum* Wittr., but in his original description Wittrock (Bot. Not. 1899, 273) uses the word only in a phrase describing a form.]

The variability of this species is partly due to extreme plasticity under different environmental conditions, and partly to the presence of genetically distinct strains. Its various forms can be classed roughly into three groups for which the correct varietal names appear to be those given above. The earliest epithet for the whole group is *pulchellum*, which was given by Swartz to the dwarf, single-stemmed, single-flowered form, figured, for example, by Butcher and Strudwick as var. *Swartziana* (Further Illustr. Brit. Pl. t.248, z). This form, the earliest varietal epithet for which is *palustre*, represents, therefore, the " nomenclatural type."

5. **C. tenuiflorum** (*Hoffmgg. et Link*) *Fritsch* in Mitteil. Naturwiss. Ver. Wien, **5**, 97 (1907).—*Erythraea tenuiflora* Hoffmgg. et Link, Fl. Portug. **1**, 354, t.67 (1809).

6. **C. latifolium** (*Smith*) *Druce* in Ann. Scott. Nat. Hist. 1905, 48.—*Erythraea latifolia* Smith, Engl. Fl. **1**, 321 (1824).

7. **C. scilloides** (*Linn. fil.* Suppl. 175 : 1781) *Druce* in Rep. B.E.C. 1916, 614 (1917), var. **portense** (Brot.) Druce, Rep. B.E.C. 1918, 290 (1919).—*Gentiana portensis* Brot. Fl. Lusit. **1**, 278 (1804).

The history and nomenclature of this species is fully discussed by Druce, l.c., and by Stapf, Bot. Mag. t.9137. Both these authors regard the European and Azorean forms as conspecific, Druce describing them as varietally distinct, and Stapf as " geographical races." Tutin and Warburg (Journ. Bot. 1932, 12) however, treat them as distinct species, stating that the Azorean form differs from the European in the narrower obovate-elliptic (not orbicular) leaves of the barren shoots, and the white (not red) flowers with narrower petals. It would appear, however, that the difference in flower colour is not constant (see Stapf, l.c.) and an examination of

the Kew Sheets shows that the other differences are very slight. It seems best, therefore, to regard the two forms as only varietally distinct.

LX—CONTRIBUTIONS TO THE FLORA OF TROPICAL AMERICA: XXXIII.* Plantae Hintonianae: V.†

Geraniaceae Novae a R. Knuth Descriptae.

Geranium cruceroënse *R. Knuth*, sp. nov.—*Herba* annua, 30–40 cm. alta, multicaulis. *Radix* saepe longissima. *Caules* numerosi, e basi ramosissimi, 1·5–2 mm. crassi, retro-pilosi, ascendentes, internodiis 3–10 cm. longis. *Folia* numerosa; lamina ambitu 5-angulata, 2–3·5 cm. diam., supra minute adpresse pilosula, subtus ad nervos hirtula, fere usque ad basin 5-partita; lobi ambitu rhomboidei, profunde pinnatifido-incisi, lobulis oblongo-linearibus acutiusculis; petiolus 1–8 cm. longus, exsicc. 1 mm. crassus, minute hirtulus. *Stipulae* lanceolato-angustatae, 4 mm. longae, basi 1·7 mm. latae. *Pedunculi* ex axillis foliorum numerosi, 1–8 cm. longi, 1 mm. crassi, sicut pedicelli bracteaeque pilis longis glandulosis densissime obsiti, glandulis deciduis. *Bracteae* 2·5–3 mm. longae, lineari-subulatae. *Pedicelli* 5–7 mm. longi. *Sepala* 4 mm. (sub fructu 5 mm.) longa, ovata, plus minusve acuminata, minute cartilagineo-mucronata. *Petala* albida, sepalis 2-plo longiora, cuneata, antice leviter emarginata. *Stamina* glabra, sepalis aequilonga. *Pistillum* hirtulum. *Fructus* 15 mm. longus, pilis glandulosis satis longis hirtellum.—Ex affinitate *G. dissecti* L.

State of Mexico. District of Temascaltepec: Crucero Agua Blanca, on the llano, 3250 m., Aug. 1933, *Hinton* 4617 (typus in herb. Kew.), "flower white"; Crucero, 2880 m., July 1933, *Hinton* 4188.

Geranium lilacinum *R. Knuth*, spec. nov. (Sect. *Mexicana* R. Knuth).—*Herba* tenera, multicaulis, perennis. *Caules* ascendentes, 40–50 cm. longi, exsicc. 1·5 mm. crassi, inferne subglabri, partibus media et superiore dense vel densissime glandulis longe stipitatis obsiti, internodiis infimis usque 12 cm. longis. *Folia* satis multa; lamina 3-angularis, saepe 3·5 cm. longa lataque, subtus ad nervos nervulosque et supra pilis simplicibus setulosis obsita, usque ad 6/7 vel fere ad basin 3 (–5)-partita, lobis ambitu anguste rhomboideis grosse serrato-laciniatis, laciniis plus minusve oblongis acutis; petioli foliorum inferiorum quam lamina 2-plo longiores, exsicc. 0·8 mm. crassi, patule vel retrorso-patule hirsuti. *Pedunculi* solitarii ex axillis foliorum, 3–4·5 cm. longi, petiolis aequicrassi, sicut bracteae pedicelli calycesque dense vel densissime glandulosi, 2-flori. *Bracteae* 4 mm. longae, e basi latiore subulatae. *Pedicelli* 5 mm. longi, 0·7 mm. crassi. *Sepala* ovato-oblonga vel oblonga, 6 mm. longa,

* Continued from K.B. 1937, 457. † Continued from K.B. 1937, 457.

2·5 mm. lata, mucrone 1–2 mm. longo filiformi terminata. *Petala* 1·3–1·4 cm. longa, e basi anguste cuneata, obovata, antice cordato-incisa, pallide violaceo-purpurea. *Stamina* basi simpliciter pilosa, ceterum glabra.

STATE OF MEXICO. District of Temascaltepec: Sierrita, in pine forest, Feb. 1936, *Hinton* 8945 (typus in herb. Kew.); Hornos, in a wet barranca, Jan. 1935, *Hinton* 7199.

Geranium pinetorum *R. Knuth*, sp. nov.—*Herba* perennis, 24–25 cm. alta. *Rhizoma* 2–3 mm. crassum, obliquum, obscure brunneum. *Folia* basalia vix numerosa; lamina facie utraque setoso-pilosa, ad 7 cm. longa et 9 cm. lata, ambitu rotundato-angulata, usque ad 4/5–6/7 partita; lobi 5, late rhomboidei, ad 5·5 cm. longi et 3·5 cm. lati, grosse pinnatifido-incisi, dentibus latis vel latissimis minutissime mucronulatis; petiolus ad 20 cm. longus, saepe multo brevior, lamina saepe 1–2-plo longior, exsicc. 1·5 mm. crassus, pilis retrorsis plus minusve hirsutus; stipulae lineari-lanceolatae, acutissimae, ad 1 cm. longae. *Caules* pauci, tenues, basi exsicc. 2–2·5 mm. crassi, pilis retrorsis plus minusve hirsuti, paucifoliati, foliis quam basalia multo brevius petiolatis, internodiis infimis brevibus, sequentibus longissimis ad 35 cm. longis. *Pedunculi* pauci, ex axillis foliorum summorum, petiolis similes, sicut pedicelli dense glanduloso-pilosi, 4–10 cm. longi, graciles, 2-flori. *Bracteae* lineari-subulatae, 5–10 mm. longae, acutissimae. *Pedicelli* 2–6 cm. longi. *Flos* 2–2·5 cm. diametro. *Sepala* ovato-oblonga, pilis longis glandulosis demum simplicibus dense obsita, 8 mm. longa, mucrone 2 mm. longo terminata. *Petala* albida vel rosea, 1·3–1·5 cm. longa, cuneato-obovata, antice retusa vel levissime emarginata, basi longissime pilosa. *Stamina* pilosa. *Pistillum* subhirsutum. *Fructus* 2·7 cm. longus, primo glanduloso-hirsutus, demum (glandulis deciduis) simpliciter pilosus.—Ex affinitate *G. crenati* S. Wats.

STATE OF MEXICO. District of Temascaltepec: Mesón Viejo, 2830 m., in pine forest, Oct. 1932, *Hinton* 1887 (typus in herb. Kew.); Hornos, in a wet barranca, Jan 1935, *Hinton* 7199. Salazar, Federal District, 1907, *Seler* 5282 (Herb. Berol.) San Rafael, District of Tlalmanalco, 1907, *Seler* 5321 (Herb. Berol.).

Geranium temascaltepecense *R. Knuth*, sp. nov.—*Herba* perennis, ad 40 cm. alta. *Rhizoma* 5 mm. crassum, plus minusve perpendiculare, brunneum. *Folia* basalia numerosa; lamina glabra, ad 4 cm. longa et 7 cm. lata, ambitu rotundato-reniformis, usque ad 6/7–7/8 partita; lobi 5, ambitu plus minusve rhomboidei, ad 3–5 cm. longi et 2·75 cm. lati, grosse pinnatifido-incisi, dentibus inferioribus ad 4 mm. longis et 3 mm. latis obtusis vel rotundatis minutissime mucronulatis; petiolus ad 16 cm. longus, quam lamina 5-plo longior, exsicc. 1·5 mm. crassus, sparsim adpresse pilosus; stipulae lineari-lanceolatae, ad 8 mm. longae. *Caules* pauci, tenues, basi 1·5 mm. crassi, retro-adpresse pilosi, paucifoliati, foliis caulinis quam basales brevius

petiolatis, foliis summis saepe subsessilibus, internodiis ad 11 cm. longis. *Pedunculi* pauci, ex axillis foliorum summorum, petiolis similes, sparsim glanduloso-pilosuli, 10–20 cm. longi, graciles, 2-flori. *Bracteae* lineares, acutae, 5 mm. longae. *Pedicelli* 1–6 cm. longi, glanduloso-puberuli. *Flos* 3 cm.* diametro. *Sepala* ovato-oblonga, 8–9 mm. longa, setosiusculo-pilosa, mucronata, mucrone 1–1·5 mm. longo. *Petala* pallide rosea, 1·7 cm. longa, cuneato-obovata, antice leviter emarginata. *Stamina* 7–8 mm. longa; filamenta sparsim longe pilosa. *Pistillum* sericeo-hirsutulum. *Fructus* 2·7 cm. longus, hirsutus.—Ex affinitate *G. Fremontii* Torr.

State of Mexico. District of Temascaltepec: Las Mesas, 2000 m., Aug. 1932, *Hinton* 1327 (typus in herb. Kew.); Nanchititla, in oak woods, Aug. 1933, *Hinton* 4533, "flowers pink, milky sap."

Additional Records of Geranium (A. A. Bullock).

The following additional species and specimens of *Geranium* were collected by Mr. Hinton. Unless otherwise stated, they have been determined at Kew by the writer.

Geranium Hernandezii *Sessé et Moc. ex DC.* in DC. Prodr. **1,** 640 (1824); Hanks et Small in N. Amer. Fl. **25,** 12 (1907); R. Knuth in Engl. Pflanzenr. Geraniaceae, 193 (1912).

State of Mexico. District of Temascaltepec: Comunidad, Aug. 1932, *Hinton* 501; Anonas, 880 m., on a dry hill, March 1933, *Hinton* 3567; Tule, in oak woods, July 1934, *Hinton* 6250; Mesón Viejo, in pine forest, Jan. 1935, *Hinton* 7220, "flower white, with red veins"; Cajones, 2520 m., in a barranca, April 1935, *Hinton* 7470; Hornos, in pine woods, Feb. 1936, *Hinton* 8913; La Labor, near water, Feb. 1936, *Hinton* 8927.

This is now a very well known species, and is at once distinguished by its large white flowers. The subulate filaments of the stamens are erect and hairy at the base, but curve outwards fountain fashion above, so that the large anthers appear to be almost pendulous.

Geranium mexicanum *H.B.K.* Nov. Gen. et Sp. **5,** 178 (182); R. Knuth *l.c.* 197, incl. "species americanae ex affinitate *G. mexicani* (sec. Hanks et Small)."

State of Mexico. District of Temascaltepec: Tempincla, April 1932, *Hinton* 483; San Miguel, 2740 m., Sept. 1932, *Hinton* 1723," 1 m. high; *ibid.*, 2770 m., on a stone fence, Oct. 1933, *Hinton* 4915; Cumbre de Tejupilco, 2000 m., in a barranca, Nov. 1932, *Hinton* 2677; *ibid.*, Nov. 1934, *Hinton* 7019; Ocotepec, about 1500 m., by water, Nov. 1932, *Hinton* 2891; Crucero Agua Blanca, 3170 m., on the llano, Aug. 1933, *Hinton* 4621, "flower pink."

The multiplicity of "species" into which Hanks and Small divided this widespread and variable plant appear to overlap each other so completely that their strict delimitation is an impossible

* See also next page.—A.A.B.

task. It seems advisable, therefore, to retain only one name for the whole group.

Geranium potentillifolium *DC.* in DC. Prodr. **1,** 639 (1824); Hanks et Small *l.c.* 20; R. Knuth *l.c.* 172.

STATE OF MEXICO. District of Temascaltepec: Las Cruces, 3350 m., in pine forest, May 1932, *Hinton* 782; *ibid.*, May 1933, *Hinton* 3988; *ibid.*, 3400 m., June 1934, Hinton 6079.

This is a very beautiful plant with large brightly coloured purple flowers and finely dissected leaves, silvery below, which are aptly described by the specific epithet. Mr. Hinton's 6079 shows the large woody rootstock particularly well.

Geranium Richardsonii *Fisch. et Trautv.* in Ind. Sem. Petrop. **4,** 37 (1838); R. Knuth *l.c.* 114.

STATE OF MEXICO.—District of Temascaltepec: Cumbre Trojes, in pine forest, Sept. 1935, *Hinton* 8271; Mesón Viejo, in a barranca, Oct. 1935, *Hinton* 8339.

These specimens were determined by Dr. R. Knuth, and appear to represent a new southern record for the species.

Geranium temascaltepecense *R. Knuth*, supra, p. 503.

STATE OF MEXICO. Cucha, District of Temascaltepec, in oak woods, Aug. 1934, *Hinton* 6393. Pazquaro, 1839, *Hartweg* 373* (in herb. Hook. et herb. Benth.). Without locality, 1830, *Graham* 152 (in herb. Benth.).

This very distinct species was well represented at Kew by the Hartweg and Graham collections before Mr. Hinton's excellent material came to hand. With flowers 3·5–4 cm. in diameter, borne in pairs on long peduncles well above the leaves, from a tufted rootstock, it should prove to be of some horticultural value.

LXI—CONTRIBUTIONS TO THE FLORA OF SIAM. ADDITAMENTUM XLV.

Symplocos ferruginea *Roxb.* var. **glabra** *Fletcher* [Symplocaceae]; a typo foliis glabris differt.

Kaw Samui, *Put* 734. Satul, Terutao, c. 5m., evergreen forest, *Kerr* 14207. Lam Saka, under 50 m., scrub, *Kerr* 15397 (*type* of *var.*). Pattani, Kao Kalakiri, c. 800 m., evergreen forest, *Kerr* 7808.

Symplocos impressa *Fletcher* [Symplocaceae]; *S. rigidae* C. B. Clarke affinis sed floribus pedicellatis nec sessilibus, bracteis minoribus differt; nec non *S. racemosae* Roxb. affinis sed foliis maioribus majus denticulatis disco hirsuto haud glabro differt.

Arbor circa 7 m. alta (ex *Kerr*); ramuli teretes, saepe verrucosi, glabrescentes, cortice griseo vel griseo-brunneo obtecti. *Folia*

* There is a line passing through the number, but it is not possible to say whether this is accidental, or means "delete."

lanceolata vel oblongo-lanceolata vel elliptica, apice late obtusa, basi attenuata, 10–20 cm. longa, 3–6 cm. lata, rigide coriacea, utrinque glabra, flava vel flavo-viridia, subtus pallidiora, costa supra leviter impressa subtus valde prominente, nervis lateralibus 6–8-paribus supra subconspicuis vel leviter impressis subtus prominentibus intra marginem anastomosantibus, margine modo argute denticulata modo valde denticulata, petiolo 1–2 cm. longo supra canaliculato leviter pubescente vel glabro suffulta. *Racemi* simplices, axillares, 3–6 cm. longi, fulvo-pubescentes ; pedicelli minuti vel 2 mm. longi ; bracteae mox deciduae, ovatae, 3 mm. longae, 2 mm. latae, extra adpresse pubescentes, intra glabrae vel sparse puberulae, ciliatae. *Sepala* late ovata vel subrotundata, 1·5 mm. longa et lata, dorso puberula, intra glabra. *Corolla* alba (ex *Kerr*), segmentis oblongo-ellipticis 5–6 mm. longis 3 mm. latis apice rotundatis, tubo 0·5 mm. alto. *Stamina* ∞ pentadelpha ; filamenta ad 7 mm. longa, gracilia, glabra, antheris parvis. *Ovarium* semi-inferum ; stylus 4 mm. longus. *Discus* conspicuus, 5-angularis, hirsutus.

Krabin, Watana, c. 50 m., open deciduous forest, *Kerr* 9789.

Symplocos Kerrii *Craib* var. **glabra** *Fletcher* [Symplocaceae] ; a typo ramulis foliis fructibusque glabris differt.

Chiengmai, Doi Pa Kao, c. 1800 m., evergreen forest, *Kerr* 5390 (*type* of *var.*).

Symplocos longifolia *Fletcher* [Symplocaceae] ; *S. rigidae* C. B. Clarke affinis sed spicis glabris vel puberulis haud pubescentibus, fructibus minoribus ovatis haud oblongo-ellipsoideis differt.

Frutex circa 5 m., altus (ex *Winit*) ; ramuli teretes vel complanati, glabrescentes, cortice brunneo vel griseo-viridio obtecti, lenticellis conspicue elevatis. *Folia* oblongo-elliptica vel late lanceolata, apice attenuata, acuta, basi cuneata vel attenuata, 15–40 cm. longa, 5–9 cm. lata, utrinque glabra, viridia, subtus pallidiora, costa supra valde impressa subtus prominente, nervis lateralibus 6–10-paribus, supra impressis subtus prominentibus intra marginem anastomosantibus, nervulis subtus prominulis, margine denticulata mox recurva, petiolo 1·5–2 cm. longo glabro supra canaliculato suffulta. *Spicae* simplices, axillares, 2–5 cm. longae, glabrae vel minute puberulae ; bracteae mox deciduae, ovatae, 5–6 mm. longae, 3–4 mm. latae, acutae vel obtusae, extra adpresse puberulae, intra glabrae, margine sparse ciliatae. *Sepala* late ovata vel subrotundata, 2 mm. longa, 1·5 mm. lata, apice obtusa, incurva, extra adpresse puberula, intra glabra. *Corolla* alba (ex *Winit*) segmentis ellipticis vel oblongo-ellipticis 5 mm. longis 2–2·5 mm. latis apice rotundatis, tubo circa 1 mm. alto. *Stamino* ∞, indistincte pentadelpha, filamenta ad 7 mm. longa, gracilia, glabra, antheris parvis. *Ovarium* semi-inferum ; stylus 5 mm. longus. *Discus* conspicuus, hirsutus. *Fructus* ovatus, basi

7 mm. diametro, apice 2 mm. diametro, lobis calycinis discum superantibus.

Lampun, Mê Li, c. 600 m., small evergreen tree near stream, fruit greenish to white, tinged purple, *Winit* 230. Lampang, Me Yom, evergreen forest, flowers white, scented, *Winit* 1435 (*type*).

Symplocos magnifica *Fletcher* [Symplocaceae] ; *S. confusae* Brand affinis sed floribus racemisque foliisque multo majoribus, nervis lateralibus paucioribus validioribus differt ; nec non *S. Maingayi* Benth. ex C. B. Clarke affinis sed foliis ramulisque glabris haud ferrugineo-villosis, floribus majoribus differt.

Arbor procera (ex *Garrett*) ; ramuli obtuse quadrangulares, glabrescentes, cortice cinereo vel cinereo-brunneo rugoso obtecti. *Folia* elliptica vel oblongo-elliptica vel leviter obovata, apice acuta, basi cuneata vel late cuneata, 15–20 cm. longa, 5·5–9 cm. lata, chartaceo-coriacea, utrinque brunnea, glabra, subtus glandulosa, costa supra impressa subtus prominente, nervis lateralibus circa 8-paribus supra leviter impressis vel subconspicuis subtus prominentibus, parallelis, intra marginem anastomosantibus, nervis transversis paucis irregularibus, margine integra leviter recurva, petiolo circa 2 cm. longo supra canaliculato glabro vel minute puberulo leviter rugoso suffulta. *Racemi* simplices, axillares, pubescentes, 4–6-flori, subumbellati. *Calycis* tubus campanulatus extra cinereo-pubescens, 2–2·5 mm. altus ; lobi 5, late ovati, 2·75–3 mm. lati, 2 mm. longi, apice rotundati, intra sericei, margine ciliati. *Corolla* alba (ex *Garrett*) ; tubus 2·3–2·5 cm. longus ; lobi 5, oblongi, 2 cm. longi, 0·4 cm. lati, apice rotundati, glabri. *Stamina* ∞ alte corollae adnata, filamentis in tubum apice truncatum corollae tubo longiorem connatis, antheris numerosis parvis intra partem superiorem tubi staminei irregulariter multiseriatis breviter stipitatis. *Ovarium* semi-inferum ; stylus 3·8–4 cm. longus, adpresse aureo-pilosus. *Discus* inconspicuus, leviter hirsutus.

Easterly spur of Doi Angka, ending in Doi Pa Mawn, c. 1420 m., *Garrett* 402.

A very distinct plant, differing from all others in the subgenus *Cordyloblaste* in the much larger flowers and the correspondingly greater length of the staminal tube.

Symplocos megalocarpa *Fletcher* [Symplocaceae] ; *S. macrocarpae* Wight ex C. B. Clarke affinis sed spicis glabris haud fulvo-pubescentibus differt ; nec non *S. cerasifoliae* Wall. affinis sed spicis glabris haud villosis, foliis maioribus obovatis nec oblongis differt.

Arbor circa 15 m. alta (ex *Kerr*) ; ramuli quadrangulares vel teretes, glabrescentes, cortice brunneo obtecti, lenticellis paucis parvis vix elevatis. *Folia* obovata aliquando oblongo-elliptica, apice obtusa, basi attenuata vel cuneata, 10–20 cm. longa, 4–8 cm. lata, coriacea, utrinque viridia subtus pallidiora, supra glabra, costa subtus leviter pilosa, costa supra leviter impressa vel subconspicua, subtus prominente, nervis lateralibus 10–12-paribus

supra subconspicuis subtus prominentibus intra marginem arcuatim junctis, nervis transversis numerosis parallelis, margine denticulata subinde saepe crenulata, petiolo 1·5–3 cm. longo supra canaliculato glabro suffulta. *Spicae* petiolum aequantes vel petiolo duplo longiores, 1·5–4 cm. longae, glabrae ; bracteae mox deciduae, obovatae, carinatae, dorso sparse adpresse pubescentes, intra glabrae, margine ciliatae. *Sepala* ovata vel elliptica, 4–5 mm. longa, 2–3 mm. lata, dorso adpresse pubescentes, intra glabra. *Corolla* alba (ex *Kerr*) non visa. *Ovarium* semi-inferum ; stylus 7 mm. longus. *Discus* conspicuus, glaber, 5–angularis. *Fructus* ellipticus vel oblongo-ellipticus, 3–4 cm. longus, 1·5 cm. diametro, 3-loculatus.

Loi, Dan Sai, Kao Kêo Kang, c. 1300 m., evergreen forest, *Kerr* 5793.

Symplocos sempervirens *Fletcher* [Symplocaceae] ; *S. Hookeri* C. B. Clarke affinis sed foliis ellipticis haud obovatis magis coriaceis, nervis supra majus impressis, racemis pubescentioribus differt.

Arbor parva, semperviva, circa 8 m. alta (ex *Garrett*) ; ramuli obtuse quadrangulares, glabrescentes, cortice brunneo obtecti, lenticellis paucis haud elevatis. *Folia* elliptica vel oblongo-elliptica, apice acuta, basi attenuata vel cuneata, 10–15 cm. longa, 3·5–7 cm. lata, rigide coriacea, utrinque glabra, brunnea, nitida, costa supra valde impressa subtus prominente, nervis lateralibus circa 8-paribus, supra impressis subtus prominentibus intra marginem arcuatim junctis, nervulis transversis subtus prominulis parallelis, margine argute denticulata leviter recurva, petiolo 2–2·5 mm. longo glabro supra complanato suffulta. *Racemi* simplices, axillares, 2–4 cm. longi, aureo-pubescentes ; pedicelli 2 mm. longi ; bracteae late ovatae vel ellipticae, circa 6 mm. longae, 5 mm. latae, extra adpresse pubescentes, intra glabrae ; receptaculum, 1·5–2 mm. altum, glabrum. *Sepala* late ovata, apice rotundata, 1·5 mm. longa, 2 mm. lata, glabra, 3·5 nervata. *Corolla* viridi-alba (ex *Garrett*), circa 10 mm. diametro, segmentis oblongo ellipticis 5 mm. longis 3 mm. latis apice rotundatis, tubo 0·75 mm. alto. *Stamina* ∞ indistincte pentadelpha ; filamenta ad 6 mm. longa, gracilia, glabra, antheris parvis. *Ovarium* semi-inferum, stylus 4 mm. longus. *Discus* conspicuus, 5-angularis, hirsutus.

Doi Pa Kao, Mê Hawngka drainage, wood whitish, *Garrett* 709.

Styrax apricus *Fletcher* [Styracaceae] ; *S. siamensi* Fletcher affinis sed fructibus dehiscentibus floribus minoribus differt ; nec non *S. benzoidi* Craib affinis sed foliis minoribus, indumento foliarum longiore ramulis crassioribus differt.

Arbor parva (ex *Kerr*) ; ramuli teretes, primo stellato-villosi, mox glabrescentes, cortice brunneo vel nigro irregulariter longitudinaliter fisso obtecti. *Folia* ovata vel elliptica vel ovato-lanceolata, apice acuminata, acuta vel obtusa, basi cuneata vel late

cuneata, 6–12 cm. longa, 3–5 cm. lata, chartacea vel chartaceo-coriacea, supra brunnea viridi-tincta, subtus cinerea vel cinereo-brunnea, supra glabra costa basi excepta, subtus dense stellato-villosa, costa supra impressa subtus prominente, nervis lateralibus 5–6-paribus supra leviter impressis subtus prominentibus intra marginem anastomosantibus, nervis transversis numerosis parallelis margine integra leviter recurva, petiolo 5–10 mm. longo supra canaliculato villoso suffulta. *Inflorescentia* racemosa vel paniculata, 5–10 cm. longa, terminalis vel axiliaris ; rachis furfuraceo-vel cinereo-stellato-villosa ; bracteae mox caducae ; pedicelli circa 5 mm. longi, stellato-villosi. *Calyx* truncatus vel minute dentatus, 3 mm. altus, intra superne tenuiter sericeus extra stellato-villosus. *Corolla* alba (ex *Kerr*) extra albo-tomentosa ; tubus 4 mm. longus ; lobi 5, lanceolati, 10 mm., longi, 2 mm. lati, intra superne subsericei. *Filamenta* 3 mm. longa, albo-pilosa ; antherae 4·5 mm. longae, pilis stellatis parce munitae. *Ovarium* circiter 2 mm. altum, albo-pilosum ; stylus 7–8 mm. longus. *Fructus* ad 1·5 cm. altus, pericarpio extra cinereo-tomentello, 1 mm. crasso in valvas tres regulariter dehiscente.

Loi, Pu Tong, c. 1000 m., open grassy forest, *Kerr* 8966. Loi, Kao Krading, c. 1200 m., open forest, *Kerr* 20133. Dan Sai, Hui Nam Man, c. 600 m., savannah and open deciduous forest, *Kerr* 5810 (*type*) 5810a.

Styrax betongensis *Fletcher* (Styracaceae) ; *S. serrulato* Roxb. affinis sed fructibus indehiscentibus, foliis majoribus subtus stellato-tomentosis haud glabris differt.

Arbor circa 10 m. alta ; ramuli teretes primo stellato-tomentelli, mox glabri, cortice brunneo irregulariter longitudinaliter fisso obtecti. *Folia* ovata vel late elliptica, apice acuta, basi late cuneata vel subrotundata, 7–14 cm. longa, 4–9 cm. lata, chartacea, utrinque brunnea subtus pallidiora, costa et aliquando nervis lateralibus supra stellato-pubescentibus aliter glaber, subtus dense stellato-tomentosa, nervis supra subconspicuis, costa subtus prominente, nervis lateralibus utrinque 6-paribus subtus prominulis parallelis intra marginem arcuatim junctis, nervis transversis numerosis parallelis, margine subintegra vel minute denticulata, petiolo 5–8 cm. longo supra complanato dense ferrugineo-stellato-villoso suffulta. *Inflorescentia* racemosa, axillaris vel terminalis, 3–6 cm. longa ; rachis furfuraceo-stellato-villosa ; pedicelli 3–5 mm. longi, stellato-villosi. *Calyx* truncatus vel minute dentatus, 5 mm. altus, intra superne tenuiter sericeus inferne glaber, extra stellato-tomentosus. *Corolla* alba (ex *Kerr*) ; tubus 4 mm. longus ; lobi 5, ovati vel ovato-oblongi, circa 10 mm. longi, 4·5–5 mm. lati, intra et extra minute sericei. *Filamenta* 4 mm. longa, apice geniculata, albo-pilosa ; antherae 5 mm. longae. *Ovarium* 0·75 mm. altum, 5-angulatum, adpresse albo-pubescens ; stylus 15 mm. longus. *Fructus* ad 1·5 cm. altus, pericarpio extra cinereo-tomentello corrugato 1–2 mm. crasso indehiscente.

Pattani, Betong, c. 200 m., scrub jungle, gum not collected from this plant, *Kerr* 7494.

Styrax siamensis *Fletcher* [Styracaceae]; *S. benzoin* Dryand, pericarpio indehiscente affinis sed foliis minoribus, nervis lateralibus paucioribus, inflorescentiis brevioribus fructibus majoribus differt.

Arbor circa 15 m. alta (ex *Kerr*); ramuli graciles, obtuse quadrangulares, primo stellato-tomentelli, mox glabri, cortice brunneo vel cinereo-brunneo irregulariter longitudinaliter fisso obtecti. *Folia* elliptica vel leviter ovato-lanceolata, apice attenuata, acuta vel obtusa, basi cuneata vel late cuneata, 5–10 cm. longa, 2–4 cm. lata, chartaceo-coriacea, utrinque brunnea vel cinereo-brunnea, subtus pallidiora, supra glabra, subtus dense griseo-fusco-stellato-tomentosa, nervis supra subconspicuis, costa subtus prominente, nervis lateralibus circa 6-paribus subtus prominulentibus intra marginem anastomosantibus, nervis transversis numerosis plus minusve parallelis, margine integra recurva, petiolo circa 7–10 mm. longo supra valde canaliculato indumento ut foliorum pagina inferiore suffulta. *Inflorescentia* racemosa, 3–4 cm. longa; rachis breviter fusco-stellato-tomentosa; pedicelli 2 mm. longi indumento ut calyce corollaque extra et foliorum pagina inferiore. *Calyx* truncatus vel minute dentatus, 5 mm. altus, intra tenuiter sericeus. *Corolla* alba (ex *Kerr*); tubus 8 mm. longus; lobi 5, lanceolati, 12–14 mm. longi, 3 mm. lati, intra superne subsericei, inferne paucissime adpresse pubescentes. *Filamenta* 5 mm. longa, albo-pilosa; antherae 6 mm. longae, pilis stellatis parce munitae. *Ovarium* 1·5 mm. altum, adpresse albo-pubescens; stylus 17 mm. longus, basi puberulus. *Fructus* globosus 2 cm. diametro, pericarpio extra cinereo-tomentello 1 mm. crasso indehiscente.

Kao Luang, c. 1200–1300 m., common in evergreen forest, *Kerr* 15493 (*type*) 15493a.

LXII—TEPHROSIA MACROPODA AS A POSSIBLE INSECTICIDAL PLANT. F. N. Howes.

This species is known in Natal and elsewhere in south-east Africa as a fish-poison plant (2). It is common in some parts of the coastal grass-veld of Natal. As legislation exists against its use in poisoning fish it is probably used less for this purpose now than it was formerly. In earlier days in Natal, an infusion of the roots with water was commonly used by settlers as a wash for freeing dogs from fleas and ticks. The root has also been used for medicinal purposes by the Zulus and as a vermin-killer for destroying lice on the head, the roots being boiled and the head washed in the decoction, or a paste made of the ground roots and well rubbed into the hair (1).

The roots of the plant have attracted a certain amount of attention as a possible insecticide in recent years (3). It would appear

that samples of the root investigated in the past have been obtained from plants growing in the wild state and that little is known regarding the plant and its habits or its behaviour under cultivation. Furthermore, as it is possible that it might be desired eventually to grow the plant on a field scale, it was considered advisable at this stage to find out more about the plant itself and its characteristics.

The Mycologist in Charge at the Natal Herbarium, Durban (Dr. A. P. D. McClean), kindly undertook to establish a small plot for observation and supplied most of the information that is given here. From these cultivated plants dried roots were obtained and their insecticidal properties investigated by the Department of Insecticides and Fungicides, Rothamsted Experimental Station.

At the outset it was thought the following were some of the points on which information was desired: (*1*) the period of growth of the plant—whether annual, biennial or perennial; (*2*) whether propagation could be effected easily by vegetative means (cuttings) and, if so, whether plants so raised mature earlier than those raised from seed; (*3*) the average weight of root-stock per plant after one and two or more years growth respectively; (*4*) the growth form of the plant under cultivation—average height and spread—as this would have a bearing on suitable planting distances.

A plot was established from seed in the grounds of the Natal Herbarium in the latter half of 1934. "The plot consisted of 12 rows, approximately 7 yards in length, and about 2 feet between the rows. The seed was sown directly in the rows—no attempt was made subsequently to thin out the plants. Germination was good. Growth was very slow in the early stages, and after three months the plants were not more than a few inches in length. The rate of growth increased during the summer and was rapid during January and February, the branches ultimately spreading a distance of 1 to 2 feet. The plants in six rows were uprooted about the middle of June and then air-dried." The air-dried roots weighed 3 lb. 10 oz. and the aerial parts 2 lbs. In the remaining rows the plants were uprooted after completing two years' growth. The site was not regarded as a desirable one owing to poor soil conditions and partial shading in the afternoon. The most suitable method of propagation was found to be by seed sown directly in the rows. The plant proved to be definitely perennial with a tendency for the aerial branches to die back partially during the winter months (June–August) when most of the leaves were shed. In the following spring growth was resumed from the living portions of the aerial branches of the previous season. The plant was found to possess a weak habit with branches spreading along the ground, some of which reached a length of three feet after the first season's growth. Plants flowered freely in the first year and set an appreciable quantity of seed. A plot established at the Sugar Experiment Station on the Natal coast, where better soil conditions

were available, proved to be a failure mainly owing to high mortality, from, it was thought, some form of root disease.

The roots harvested after two years' growth were a good deal larger than those from one season's growth, the average weight of a few specimens (air dried) taken at random being—for one year's growth $\frac{3}{4}$ oz. approx., and for two years' growth $2\frac{1}{2}$ oz. In the fresh state the roots are somewhat fleshy and tuberous, there being as a rule, a single main root to each plant. The roots are long and tapering with the thickest part just below soil level and more often unbranched or but little branched. The dried two year old roots received were mostly two to two-and-a-half feet in length and one inch in diameter at the thickest part. They were markedly larger and less contorted or twisted than roots collected in the wild state (at Scottburgh, Natal) by the writer some years ago, this being probably due to their having been grown in a deep, well tilled soil.

The results of the testing of the one and two year old cultivated roots at Rothamsted were as follows.

Concentration in percentages of root.	2 year old roots tested June, 1937, % paralysed and dead insects.	1 year old roots tested July, 1936, % paralysed and dead insects.
0·5	100	100
0·25	100	96
0·2	—	92
0·1	50	14
0·075	20	—
0·05	—	—
0·025	—	—
Control Saponin 0·5 per cent. wt./vol. Alcohol 5 per cent. by vol.	3	3·8

The figures suggest an improvement in insecticidal value due to the second year's growth in which respect the plant shows similarity with Derris. However, the insecticidal value of these samples of roots from cultivated plants was regarded as insufficient to warrant the belief that they would compete with Derris root in the European or American market, although it was thought the roots might be of use locally, probably as a dust.

A comparison of these figures with similar figures obtained in earlier tests (3) with roots from other sources in Natal shows apparent differences in the degree of toxicity. It is possible, therefore, that forms or varieties of the plant with varying degrees of toxicity exist and it is not unreasonable to suppose that, by selection or breeding, strains with superior insecticidal properties might be obtained, as has been done with *Derris*. The fact that the plant flowers and sets seed readily in its first season under normal conditions and can be propagated vegetatively, may be an advantage should work of this sort be undertaken at any time.

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3. Tattersfield, F. and Gimingham, C. T. " The Insecticidal Properties of *Tephrosia macropoda* Harv. and other Tropical Plants," in *Annals Appl. Biology*, **19**, no. 2, pp. 253–262 (1932).

LXIII—MISCELLANEOUS NOTES.

Sir Herbert Eustace Maxwell.—With the passing of Sir Herbert Maxwell, Bt., K.T., F.R.S., whose death occurred at Monreith, his home in Wigtownshire, on October 30th, a unique figure in horticulture has gone from our ken. He was nearly 93 years of age, and his eminence was such that he might rightly, towards the end of his career, be regarded as the Nestor of gardening.

It was probably the singularly favourable climatic conditions of Monreith, which is situated on the south-west side of Luce Bay, that originated and developed his taste for horticulture, for it is one of those places where very many trees and plants can be grown which are impossible for the great majority of gardens in Britain. This fact enabled him to send to the press a steady flow of essays and notes—on rare trees and shrubs especially—that were always interesting and informative. Pure botany did not appeal to him, but his interest in a plant was certainly not restricted to its beauty or garden value ; it extended to its peculiarities of structure, its behaviour under different conditions, and especially to its legendary or local associations.

He was a stickler for correct pronunciation of names and one never perpetrated a false quantity in his hearing without receiving a correction, or even a reproof, if the offence were flagrant enough. Although he went down from Oxford without taking a degree, he was strongly attached to the classics. Above or on the door lintels at Monreith were inscribed various adjurations and mottoes in Latin, and to the south of the house clipped box is planted so as to read " Homo quasi flos egreditur et conteritur " (Man cometh forth like a flower and like a flower is he crushed).

His writings in connexion with gardens and plants were only one item in his literary work. It would, indeed, be difficult to name any one of his contemporaries whose interests were more diverse. Whilst such of his books as " Memories of the Months," " Woodland Notes," " Trees," " Flowers," dealt wholly or very largely with plant life, others were concerned with history, biography, archaeology, topography, forestry, sport and various other subjects. He even published some half a dozen novels, mostly with a historical setting.

His relations with Kew were always cordial, and extended over the last thirty years. They were mostly concerned with the exchange

of plants on a " quid pro quo " basis. One of his noteworthy contributions was a hundred young plants of the Serbian spruce (*Picea Omorika*) which he had raised from native seed at a time when the tree was very rare in Britain. This is the best of the spruces in withstanding the effects of London smoke and the groups and odd specimens of it at Kew we owe to Sir Herbert.

No account of his activities would be complete without some mention of his artistic capabilities, more especially in the portraiture of flowers. He appears to have devoted himself to this work in his later and more leisured years. He had the faculty of presenting his subject with sufficient exactitude and detail to make it easily recognizable without losing its grace and charm, as purely botanical portraits are apt to do. Reproductions of his pictures in colour have appeared in " The New Flora and Silva " and " The Gardeners' Chronicle," and the originals have been exhibited in the Royal Horticultural Society's Hall at Westminster.

W. J. BEAN.

A New Species of Streptocarpus.—It has been realized for some time that there are a number of forms allied to *Streptocarpus polyanthus* Hook. which cannot be satisfactorily classified from the meagre herbarium material available, but which may well prove to represent two or three distinct species. *S. gracilis*, described below, is one of these and it is its introduction into cultivation in this country which has made it possible to recognize it as a new species.

It was grown at the John Innes Horticultural Institution at Merton from seed received from Kirstenbosch Botanic Garden (under the number 588/32) as *S. polyanthus*, but a plant presented to Kew flowered alongside the true *S. polyanthus* Hook., and is evidently quite distinct. *S. polyanthus* is well illustrated in the Botanical Magazine (t. 4850), and differs from *S. gracilis* in its larger, bluer flowers, broader corolla lobes and much stouter inflorescence. The seed of *S. gracilis* was originally obtained from Kloof, Natal, and a specimen collected by Sanderson at Fields Hill seems to belong to this species ; this specimen was referred to *S. polyanthus* (Bot. Mag. t. 4850) by Hooker and to *S. pusillus* Harv. by C. B. Clarke, facts which serve to illustrate the difficulty of identifying dried specimens of this genus.

Streptocarpus (**Eustreptocarpus**) **gracilis** *B. L. Burtt*, sp. nov. ; *S. polyantho* Hook. affinis, sed pedunculis gracilioribus, floribus minoribus, corollae tubo magis curvato lobis angustioribus facile distinguitur.

Herba acaulis, unifoliata. *Folium* basi cordatum, basin versus 8 cm. latum, crassum, utrinque densiuscule pubescens, nervis subtus valde prominentibus. *Inflorescentiae* plures e basi folii orientes, usque ad 15 cm. longae, pluriflorae, breviter et patule glanduloso-pubescentes. *Flores* bini, collaterales, bracteis duobos oppositis 1·5 mm. longis setoso-pubescentibus, pedicellis 1 cm. longis.

Calyx ad basin 5-partitus, segmentis lanceolatis 3 mm. longis breviter et rigide pubescentibus. *Corolla* pallide purpurea fauce flava; tubus 1 cm. longus, declinato-curvatus, fauce a lateribus compressus, intus breviter pubescens, extra glanduloso-pubescens; limbus obliquus, lobis oblongis vel oblongo-obovatis rotundatis intus et extra breviter pubescentibus, lobo anteriore 6 mm. longo et 4·5 mm. lato, antero-lateralibus 7·5 mm. longis et 4·5 mm. latis, postero-lateralibus 7 mm. longis et 3·5 mm. latis. *Stamina* 2, fertilia, filamentis crassis leviter curvatis basin versus brevissime pubescentibus medio corollae tubo insertis, antheris cohaerentibus bilocularibus, loculis divergentibus apicibus confluentibus. *Discus* annularis, undulatus. *Ovarium* cylindricum 4·5 mm. longum, appresse pubescens, multiovulatum. *Stylus* brevissimus, crassus, stigmate capitato.

South Africa: Natal. Kloof, 22 miles from Durban on the railway to Maritzburg; cultivated at the Kirstenbosch Botanic Garden, n. 588 1932 (spec. in herb. Bolus), at the John Innes Horticultural Institution, and at the Royal Botanic Gardens, Kew (type spec. in Kew herb.). B. L. BURTT.

Further notes on Mexican Species of Bursera*.—In view of the fact that sets of Mr. Howard Scott Gentry's Mexican plants have been distributed to various herbaria, the following notes may be of interest:—

No. 2245, **Bursera confusa** (*Rose*) *Engl.* There is no doubt that this is conspecific with No. 2266a, distributed as *B. confusa* (Rose) Bullock. As pointed out in Kew Bull. 1937, 448, this combination was made *de novo*, by an oversight, in Kew Bull. 1936, 356.

No. 2260, **Bursera laxiflora** *S. Wats.* This was distributed as *B. odorata* Brandeg. and is an evident misidentification. The specimen is exactly similar to the type-specimen of *B. concinna* Sandw., which was reduced to *B. laxiflora* by the writer in Kew Bull. 1936, 370. It is of interest to note that the present specimen is from Sonora, where the type of *B. laxiflora* was collected, whereas the type of *B. concinna* was collected in Sinaloa.

No. 2383, **Bursera stenophylla** *Sprague et Riley.* This was distributed as *B. bipinnata* (DC.) Engl., but it so closely matches the type of *B. stenophylla* that I have no hesitation in changing the identification. This new collection of a plant which I have previously suggested (Kew Bull. 1936, 376) might be of hybrid origin, in an area in which at least one of the suggested parents occurs, makes the collection of further specimens and data most desirable.

A. A. BULLOCK.

The Cabot Foundation for Botanical Research.—We are pleased to hear that Harvard University is the recipient of a fund of $615,773 from Dr. Godfrey L. Cabot. The gift will be known as

* See Bullock in Kew Bull. 1936, 346–387, and Kew Bull. 1937, 352.

the Maria Moors Cabot Foundation for Botanical Research and will be devoted to a long range research programme for increasing the production of cellulose by plant breeding, especially tree breeding, and by improving forest soils. The donor foresees a time in the not very distant future when the world supplies of coal and oil approach exhaustion and wood will become one of the main sources of energy. The realization that such a state of affairs is not very remote is becoming widespread and the moment is an opportune one for setting in motion a research programme in tree breeding and its related problems, which will necessitate the patient work of several generations of investigators to bring to a successful end. The conditions of University work provide for the essential continuity necessary to achieve this object.

Work will be carried on mainly at the Harvard Forest, Petersham, Mass., the Arnold Arboretum and in the University Biological Laboratories. Professors E. M. East and Karl Sax will study hybridization and such problems as the doubling of the chromosome numbers with the object of increasing the size, vigour and hardiness of trees. Vegetative propagation will be in the care of Prof. K. V. Thimann and physiological problems, especially in mineral nutrition, will be the province of Prof. P. R. Gast.

Forest Reserves in the Seychelles. — We learn from Mr. F. L. Squibbs that an area of some 200 acres of mountainous country in the Island of Praslin has recently been acquired by the Government as a Forest Reserve. Previously to this an adjacent area of about 30 acres was set aside for permanent preservation through the generosity of the owner, Mr. France Jumeau. This latter area forms a natural gateway to one of the principal " Coco de Mer " valleys, the " Vallée de Mai," where nearly 4,000 trees of the double coconut have recently been counted.

Though containing a number of endemic trees, these reserves do not represent truly original forest, having been considerably modified by cutting and possibly burning. It is doubtful, indeed, if any virgin forest now exists in the Seychelles.

Plant Preservation in New Zealand.—We learn with interest that a Native Plant Preservation Society, Incorporated, has recently been formed, with headquarters at Lower Hutt, Wellington. The objects of the Society are (*a*) the preservation both in nature and in cultivation of rare plants indigenous to New Zealand and its outlying islands, (*b*) the cultivation of such plants for experimental purposes and distribution, (*c*) the preservation of the indigenous flora generally and the discouragement of its destruction, (*d*) to take any other steps from time to time incidental or conducive to the attainment of the Society's objects, (*e*) to act in co-operation with the Government, or any Society or Institution, for the promotion

of the above objects. Further information can be obtained from the Secretary, P.O. Box 34, Petone, New Zealand.

Chronica Botanica.—We learn from the Editor that from February 1938 this publication will be issued bi-monthly and no longer as a year-book. The annual subscription will be reduced from 15 to 7 guilders. The new periodical will continue to give all the essential information which was given in the old year-book and will include some important new sections as well. Like the year-book the new Chronica will aim at promoting documentation, goodwill and international co-operation among plant scientists. Results of research will be published only in the first two sections. The world list of plant science institutions and societies will appear as an annual supplement. The contents of the reorganized Chronica will be as follows :—

1. *Scientific Communications* : a medium for the quick publication of short preliminary notes on the results of recent research or announcing new discoveries.
2. *Forum Botanicorum* : Discussions, Announcements, Letters to the Editor.
3. *International Congresses* : Detailed programmes, short reports, decisions, resolutions, etc.
4. *Quotations* : from recent articles of general and timely interest.
5. *Miscellaneous news* : News notes of all kinds of plant science institutions, experiment stations, gardens, etc., including notes on new research projects.
6. *Herbarium and Museum News* : Expeditions, new collections, lists of new acquisitions, etc.
7. *Personalia* : Appointments, Retirements, Resignations, Deaths (short obituaries), Miscellaneous, New Addresses.
8. *Queries* : Requests for co-operation and information, exchange offers.
9. *New Periodicals* : Short accounts of new plant science periodicals, changes in existing periodicals.
10. *New Books* : Short reviews of new plant science books.

Overseas Plant Products.*—Mr. J. H. Holland, the author of this work, was for over thirty years a member of the Museums staff at Kew. Before joining the Kew staff he was in the Agricultural Service in Nigeria (Southern Nigeria Protectorate), and is known to many as the author of " The Useful Plants of Nigeria." As stated in the Director's foreword, part of the author's official duties at Kew was the identification of samples of economic plant products of various types received mainly from commercial houses in this country. Such samples originate from all parts of the world, and although often accompanied by names by which they are

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* By J. H. Holland. John Bale, Sons & Curnow, Ltd., London, 1937. Pp. 279. Price 6*s.* net.

known in the countries of origin, these names seldom afford any clue to the identity of the product.

For his own use the author commenced the compilation of a list which he drew up not only from specimens received at Kew for identification, but also from various publications and other sources. This work, which he completed after his retirement, has now appeared in book form. The information thus brought together with much care and trouble should prove of great use not only to Import and Export houses, but also to all those concerned with the raw materials of industry. It should also appeal to students of economic botany and geography, and, in fact, to all those interested or concerned with any of the various groups of useful plant products furnished by the vegetable kingdom, such as food-products, fibres, tans, drugs, spices, timbers, etc. In his preface the author expresses the hope that the information supplied " will be of value to Produce Importers at home or their agents in the various countries where they have commercial interests, and also to Commercial Intelligence Officers attached to British Embassies in Foreign Countries. It shows what is already on the markets, and will serve as a guide to our trade resources of raw materials in demand for various industries."

The arrangement throughout is alphabetical according to the common or trade name, these being correlated with the botanical name (specific and family), and information is given as to the sources or countries of production and uses. Under each of the general headings of main commercial commodities such as beans, dyes, gums, nuts, etc., an enumeration of the particular products or individual species concerned is given, for instance, under " dye-woods " are given camwood, fustic, logwood, redwood or barwood and sappanwood.

The following is an example of the value of the book and of the type of information supplied. A few years ago some kernels labelled " almondettes " were received at Kew from a commercial source. They were identified eventually as *Buchanania latifolia*, though the name " almondettes " afforded no assistance. On turning to " almondettes " in Holland's volume, the following information will be found :—" *Buchanania latifolia* (Anacardiaceae) ; India and Burma—in dry forests. The fruit contains an edible kernel—eaten as food in India and sometimes as dessert nuts, similar to ' Pistachio ' nuts, by Europeans. An oil is also obtained from the kernels, which are known as ' Cuddapah Almonds ' (Almondettes) and ' Peru Palm Kernels '—suggested for use in confectionery."

It is obvious, in view of the wide scope of the book, that it would be impossible to give full details of all the products dealt with in the space available. The very full bibliography, however, at the end of the volume indicates where further information on the various products may be obtained. The bibliography is arranged according to subjects, commencing with " Drugs, Medicinal and Culinary herbs." For statistics and conditions governing Imports

and Exports of the trade products mentioned, the reader is referred to the requisite official reports. F. N. HOWES.

Flora of Southeastern Washington.—Professor St. John's book* is the result of studies made during nine years of residence in Pullman, Wash., and seven years of study since then. The author acknowledges his indebtedness to Piper and Beattie's Flora of Southeastern Washington (1914), which indeed he cites, for the sake of brevity, as "ed. 1." Whereas Piper and Beattie described 1139 Pteridophytes and Spermatophytes, St. John distinguishes 1473, of which 1187 rank as species, and 286 as subdivisions of species. The earlier work included 9 species and one minor group (under a trinomial, with rank unspecified) of *Epilobium*, while the new one recognizes 10 species, 5 varieties and 4 forms, all included in the clavis. *Epilobium franciscanum* of ed. 1 is referred to *E. Sandbergii*, *E. adenocaulon* and *E. occidentale* are treated as varieties of *E. glandulosum*, and *E. fastigiatum* as a variety of *E. glaberrimum*. These and similar examples which occur throughout the book, afford evidence of fresh intensive study, and justify its issue as a new work instead of as a new edition.

Five life zones are recognized: the Upper Sonoran, or zone of the arid regions; the Arid Transition Timberless, or zone of grass lands or prairies; the Arid Transition Timbered, or zone of the open yellow pine forests; the Canadian, or zone of moist dense woods on the middle slopes of the mountains; and the Hudsonian, or zone at the upper limit of trees on the mountains. Indicator species are listed for each of the life zones, but "detailed studies have shown that few, even of the indicator, plants are absolutely constant to one life zone. If their entire geographic range is considered, it is often found that they occur in two or more life zones. Also, if a number of indicator species of one zone are studied and their ranges mapped in detail, it will be seen that their ranges do not exactly coincide. Hence the life zones do not seem to be scientific concepts capable of precise definition. On the other hand they are generalizations of the mass association of plants characteristic of the great physiographic and climatic areas. They have a meaning and a use. To the naturalist, the name Upper Sonoran brings an indelible picture of hot, arid plains or canyons with sagebrush, cactus, jack-rabbits, and horned toads. The name Canadian brings an image of deep moist woods in the mountains, with the shade and fragrance of spruce, fir, and cedar."

For the purposes of general classification the author has followed the system of Engler and Prantl, which he considers to be the best hitherto published. He has deviated from it in only a few cases,

* "Flora of Southeastern Washington and of Adjacent Idaho." By Harold St. John, Professor of Botany, The State College of Washington, 1920–1929. Published by the Students Book Corporation, Pullman, Washington, 1937. Pp. xxv+531. Cloth, $3.50; paper, $3.00.

as in the acceptance of the *Lobeliaceae* and *Fumariaceae*, and the rejection of the *Cupressaceae*.

The nomenclature is stated to be in accordance with the International Rules of Botanical Nomenclature, ed. 3 (1935), with such modifications as were introduced at Amsterdam in 1935. Short Latin diagnoses are given, in order to validate publication of the name, after the English descriptions of new species, *e.g.*, *Horkelia caeruleo-montana* St. John and *Glossopetalon stipuliferum* St. John. Errors in nomenclature and typography seem commendably few: *Brassica arvensis* (L.) Rabenh, is a later homonym of *B. arvensis* L. (1767), and the correct name for the species, under *Brassica*, is *B. Sinapistrum* Boiss. The specific epithet of *Matricaria matricarioides* should be spelt with a small initial letter, since it was merely a word signifying resemblance to a *Matricaria*, and was not a generic name used as a specific epithet.

The common names supplied are "either genuine folk names actually in current use in this area, or names of widely distributed species that are almost universally accepted." The author has shown good judgment in excluding book-made English names, such as the translations of the Latin names.

Analytical keys to the families are prefixed to the main body of the work, and a glossary of technical terms, and an explanation of authors' names, with their dates of birth and death, are appended. These are followed by a list of new species and combinations—a great boon to the bibliographer. Scientific and common names are sensibly included in a single index.

The final verdict on the merits of a new flora can of course be given only after testing it in the herbarium or the field, but inspection of Professor St. John's book suggests that it will prove to be a thoroughly practical handbook. Its publication adds materially to our knowledge of the flora of South-eastern Washington and Idaho. T. A. SPRAGUE.

Chrysanthemums of Japan.*—The mystery surrounding the origin and development of the garden race of Chrysanthemums is taken a step further towards solution by Professor Niwa in his latest book. Originally published in 1936 in Japan for Japanese horticulturists, so much interest was taken in it that it has now been translated into English.

The credit for the raising of this wonderful race of plants rests with Japanese breeders, who have been cultivating them—as records show—for the last eight hundred years. According to the author there is a record that the Emperor Kwammu at an Imperial Banquet in October 797, recited an ode on Chrysanthemum flowers and he states that several poems existed before that period. Since

* By Teïzo Niwa, Professor of Floriculture and Landscape Gardening, Faculty of Agriculture, Tokyo Imperial University. George Allen & Unwin, Ltd., London, 1937. Pp. vi + 56 + 4. 80 colour plates, 4 impressions of petals and 20 of leaves. Price 12*s.* 6*d.*

the plants found favour with the Emperor, the nobility—and later the common people—took up their cultivation. The Chrysanthemum was soon looked upon as the Queen of Flowers, and has been lauded in prose and poetry for the last thousand years.

Much has been written on the origin and history of the Japanese Chrysanthemums, and many authors have held that two species only, *C. sinense* (syn. *C. morifolium*) and *C. indicum*, were the progenitors of the race. Professor Niwa now propounds another theory and suggests that in addition three other species are concerned, viz., *C. boreale*, *C. japonicum* and *C. satsumense*; he points out that these also have a morphological resemblance to cultivated Chrysanthemums. To test his own theories he has cultivated over thirty thousand plants of these five species, and has found that hybridization is possible amongst four of them, and that large-flowered varieties can be developed from the single-flowered types. As a result, he believes that this race of plants has resulted from complex intercrossings helped by mutations from the wild types and that all the intermediate varieties have been lost in the interval. The author points out that—apart from his own work—there is a total absence of any scientific data on the genetics of the genus. All the five species mentioned as possible parents have either white or yellow flowers, and the question is raised as to where all the numerous colours of this hybrid race could have come from. What all writers, including Professor Niwa, appear to have overlooked is that in the white-flowered *C. sinense* there is a reddish or plum shade on the underside of the ray-florets and that this colour may well have been diffused or split up and blended with the yellows of *C. indicum*. We know that this has happened with the hybrid races of Gerberas, Primulas, and the modern Petunias of our gardens.

The first Japanese Chrysanthemums reached Europe in or about 1688, and were then cultivated in Holland, but soon died out. A number of varieties were introduced from China to France in 1789 and thence to England, where they have been largely cultivated ever since. In 1795 a plate of a red-coloured variety appeared in the Botanical Magazine, t. 327, under the name *C. indicum*.

The author figures 111 garden varieties and four of the species which he considers are the progenitors of the race; these form the subject of 80 beautiful plates in natural colours. On plate 78 the author figures a yellow and a magenta variety of semi-double form, one of a group of "edible Chrysanthemum." The flower petals are eaten without distinction of colour and have a sweet flavour. Their use as an article of food appears to be peculiar to Japan. As a medicine, their use in China can be traced back for over a thousand years.

Nothing is said by Professor Niwa on the Japanese methods of cultivation of these plants, a subject on which all Europeans would like to have had some information, as it is well known that the Japanese excel in cultural methods. C. P. RAFFILL.

Bulletin of the Colonial Institute of Amsterdam.*—We have recently received the first number of this Bulletin, published by the Institute in collaboration with the Netherlands Pacific Institute. In the Foreword it is stated that "this new periodical is published with the object of creating an organ by means of which a double aim may be achieved: to lay before the world outside our own country and its dependencies, in the English language, subjects of current importance in the Netherlands Indies, and, furthermore, to inform the Dutch reading public of events and conditions in Pacific countries which deserve their attention." The first number contains an Introduction outlining the organisation of the Colonial Institute, six articles, written in excellent English, on various aspects of Netherlands colonial life and administration, and one article in Dutch. To biologists the article on "Malaria in the Netherland Indies" by Professor N. H. Swellengrebel will be of special interest. We cordially welcome the appearance of this Bulletin, which should prove a most valuable medium for making known the aims and methods of Netherlands colonial administration.

The Stapelieae.†—Less than three and a half years have elapsed since the first edition (October 1933) of White & Sloane's account of the *Stapelieae*, containing 206 pages and 236 photographic reproductions, was published. In this comparatively short time the joint authors must have been working at high pressure to complete the three magnificently illustrated volumes now in print. This work is beautifully produced and consists of 1,185 pages interspersed with 1,233 photographic reproductions and 39 coloured plates. This is more than five times the size of the original work.

The book is divided into four parts and has in addition a useful appendix. The first part introduces the *Stapelieae* and discusses their systematic position, the variation of floral structure within the group and the pollination mechanism and seed dispersal. Then follows a most valuable chapter on the distribution of the species. The separate regions are dealt with in turn, and under each regional heading the species are enumerated with their approximate localities and the edaphic and climatic factors set forth. This chapter is illustrated by excellent figures of the plants in their natural surroundings and is a most useful adjunct to the second edition. The third part consists of short chronological notes of the various workers interested in the *Stapelieae*, beginning with Justus Heurnius (1624) and ending with those of the present day. This chapter

* Published quarterly in collaboration with the Netherlands Pacific Institute, Amsterdam, Vol. 1, no. 1, November, 1937. Subscriptions, post free, per annual volume, fl. 7·50 or U.S.A. $4·50 or 18*s.*, payable in advance to the Editor of the Bulletin, Koloniaal Institut, 63 Mauritskade, Amsterdam, O, Holland.

† By A. White and Prof. B. L. Sloane. Second Edition, 3 volumes. Scott E. Haselton, Abbey San Encino Press, Los Angeles, 1937. Pp. xiv + 1185 + 3 × 23. Illustrated. Price $14, post free.

was included in the first edition, but here has been amplified to include a number of more recent workers and also field collectors.

The fourth part is a great advance on the corresponding section in the first edition and the treatment approaches that of a monographic study. A key to the genera and species has been added and, furthermore, the synonymy is fairly fully dealt with. There is, in most cases, in addition to the description, a representative figure of each species, which is of particular value when dealing with the complicated floral structure of the *Stapelieae*. A number of species and four genera have been added since the first edition, two of these latter are new (*Luckhoffia* and *Drakebrockmania*), and one genus (*Sarcophagophilus*) has been reduced. It is unfortunate that *Drakebrockmania* White et Sloane is a later homonym for which Chiovenda has substituted the name *White-Sloanea**. The appendix contains eleven sections by a number of different authors and useful information is here given on various interesting points. A map and distributional table are included in the first volume and in the second there is a coloured vegetation map of South Africa. Separate indices of plant names and persons appended to each of the three volumes complete a very fine piece of work. It is to be hoped, however, that the third edition will show more uniformity in the nature of the descriptions and the system of measurement employed, as this will facilitate the comparison of species. A fuller reference also to the literature and citations of herbarium types and material, with notes as to where the types are to be found, would enhance the value of the work and make the book indispensable to any taxonomist working on this fascinating group. E. A. BRUCE.

Bibliography of Plant Diseases†.—With the ever-increasing volume of botanical literature, most workers have felt the need for compiling some sort of card index, with or without annotations, in order to keep themselves abreast of developments in the particular branch of botany in which they are interested. Dr. Ainsworth has conceived the happy idea of putting into print such an annotated index to literature, for the benefit of British plant pathologists. He has collected together what he calls " key references " for the principal plant diseases of Great Britain, and in many cases adds notes giving a brief indication as to the scope of the paper indexed. In selecting his references Dr. Ainsworth has put accessibility among the first considerations, and while he has aimed at listing all the more important papers published in this country, his choice from foreign literature has necessarily been somewhat more arbitrary. References are given to abstracts published in the Review of Applied Mycology, so that if the original paper is not accessible an abstract at least can be found.

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* Chiov. in Malpighia Vol. 34, 541 (1935-37).

† " The Plant Diseases of Great Britain. A Bibliography." Compiled and annotated by G. C. Ainsworth. Chapman & Hall, Ltd. 1937. Price 15/- net.

The diseases included are arranged according to crops, following the order used in the Ministry of Agriculture's Reports on the occurrence of Fungus Diseases of Crops in England and Wales 1920–1932, with the addition of a section on diseases of trees. In each crop-group the host plants are arranged alphabetically as to their generic names, in the classes Dicotyledons, Monocotyledons and Gymnosperms. The diseases are arranged under each host plant in systematic order of the causal agents, as in the List of Common Names of British Plant Diseases issued by the British Mycological Society.

On the whole, Dr. Ainsworth appears to have compiled very well. A test check of all references given to the Hyphomycetes showed only one wrong reference, and two minor slips which are probably typographical errors. As anyone with experience of indexing references knows, mistakes in such work are fatally easy, and difficult to detect in proof-reading, so that the few found cannot be considered an undue proportion. On the other hand, mistakes in the spelling of scientific names are far too numerous, and if a second edition is called for, Dr. Ainsworth would be well advised to have his names checked by a systematist.

The book is well got up and of convenient size, and will certainly be found useful as a handy work of reference to be kept on the desk of the practical pathologist. The price, however, is rather high for the type of work. E. M. WAKEFIELD.

Par-boiled Rice Oil.—The practice of par-boiling rice has been carried out in the East on a domestic scale since early times and in later years on a large scale by rice-mills. Briefly the process consists of soaking the grain (still in the husk) in water for a time and then boiling or slightly steaming, although not sufficiently to cause cooking. Drying follows and the grain is then dehusked or milled in the ordinary way. This treatment has the effect of toughening the kernels and of facilitating their removal from the husk, thereby reducing the percentage of broken grains in milling and increasing the output of whole rice. Such rice keeps better after milling, is less likely to deteriorate on long sea voyages, and does not readily turn sour after cooking like ordinary rice. It is also claimed to require rather less cooking and therefore less fuel, a consideration with peasants in some areas. There is no appreciable change in food value compared with ordinary rice, although the taste may be altered slightly. Among many communities par-boiled rice is always preferred for food and large quantities are exported from important rice-producing countries. The great advantage to millers is that they obtain considerably less of the lower priced broken rice.

A peculiar character of par-boiled rice is the greatly increased percentage of oil in the rice bran or " meal " that is obtained from it. Rice bran or " meal " is obtained in milling during decortication, and

consists of the outer cuticle, much of the glutin layer and the "germ" or embryo. This increased oil percentage in the bran is dealt with in an interesting manner by R. Auriol* who points out that the average oil content of ordinary rice bran in French Indo-China is 13·5–14·5 per cent., whereas for par-boiled rice the figures are 24–25 per cent. The increase is attributed to the influence of pressure, temperature and steam during the par-boiling process.

The oil is described as non-drying, yellowish brown in colour with an odour which is not disagreeable and which is suggestive of rice bran. It was found to be easily saponified, even in the cold, and to bleach readily. The physical and chemical characteristics differed somewhat from those of the oil of ordinary rice bran. A notable feature about the oil was the small amount of free fatty acid present, attributed to the fact that the enzymes normally present in the seed coat are destroyed during the process of par-boiling. The resulting press-cake from oil extraction is an excellent cattle food.

F. N. HOWES.

The Seed-drift of South Africa†.—Very welcome is any addition to our knowledge of plant-dispersal, and especially so is an account of the migration by sea-currents of the seeds on South African coasts where hitherto very little on this subject has been recorded. Dr. Muir's research into this question as well as his ecological account of the strand flora of this area are of considerable importance.

As might be expected, seeds drifted from the tropics on reaching the colder climate of South Africa either fail to establish themselves or, if they do, develop only as dwarfs of the original forms, as is the case in *Xylocarpus granatum* in which it appears that the whole plant, fruit and all, is very much reduced in size.

In order to diagnose accurately the region from which sea-drifted seed is derived, it is essential to identify correctly the species or variety of the seed. This has not been easy in the cases of *Entada* and *Mucuna* so commonly found in sea-drift. Both genera require more careful and critical examination than they have received. *Mimosa scandens* L. (*Entada scandens* Benth.) certainly includes two if not three species, and *E. gigas* Fawc. et Rendle of the West Indies appears to be quite distinct from the African species, though the author assumes that the S. African drift seed belongs to it. The difficulty lies in the insufficiency of herbarium material and of due correlation of the fruits with the flowering specimens, as well as in our present meagre knowledge of the flora of Madagascar from which

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* "Note Sur l'Huile de Riz Etuve." R. Auriol, Chef de la Division de Chimie, d'Agrologie et de Technologie à l'Office Indochinois du Riz. Bulletin Economique de L'Indochine 40, fas. 11. 1937. Pp. 352–3.

† By John Muir, M.D., D.Sc. (Edin.), D.Sc. (Stell.) Union of South Africa, Department of Agriculture and Forestry. Botanical Survey Memoir No. 16. The Government Printer, Pretoria, 1937. Pp. 108. 15 plates, 6 photographs and 1 map. Price 2*s.* 6*d.*

island the drift seeds probably came. It should be possible to identify the seeds with the complete plant, and were this done as the author suggests it might revolutionize the story of the distribution. Much the same may be said of *Mucuna*, the seeds of which are not at all easy to identify.

The author mentions the dispersal of some plants by floating joints, citing *Arthrocnemum, Salicornia, Disphyma* and *Sesuvium*—plants in which the seeds have no buoyancy, yet they are widely dispersed. Information on the period of survival in the sea of such portions of sea-drifted plants is most desirable. There is a good account of the currents affecting the coast as illustrated by bottle-drift, and a map showing their directions, the most important of which are undoubtedly those passing the coast of Madagascar. Currents from S. Africa to S. America are recorded, but plant geography of these two areas does not suggest the transfer of seed alive between these countries.

This interesting and careful work contains twenty-one photographs of coast vegetation and sea-drift seeds.

H. N. RIDLEY.

Plant Ecology.*—The increasing development of plant ecology and its now generally recognized value as an introduction to biology has led to the publication of fairly numerous text-books. Apart from the desirability of correlating and co-ordinating new knowledge the need for text-books in ecology is increased by the facts that much ecological research is published in either a rather verbose or a statistical form, often without adequate summaries, and is scattered in many periodicals. The subject, moreover, has such wide contents that specialists in one branch are often glad to have general reference works available for consultation. One looks forward to the publication of a series of ecological text-books of a more specialized nature than most of those at present published in this country.

The work now under notice has much to commend it as an introduction to the synecology of the British Isles. The format is adequate, the text is very clearly written, and the illustrations (all except one of which are from photographs by Prof. E. J. Salisbury, F.R.S.) are excellent. The simple title, " Plant Ecology," is, however, too wide. Essentially the book is a brief account of ecological factors followed by an account of the plant communities of the British Isles. Little or nothing is said about the important subjects of experimental ecology and autecology. This omission may give those students to whom it is most likely to be useful a false impression both of what has been done and what remains unknown in these most important branches of ecology. The research aspect is, indeed, less emphasized than it should be in this book. Students should, from the beginning of their studies, be urged to work out

* By Hilda Drabble. Edward Arnold & Co., London, 1937. Pp. 142, plates 12. 7*s*. 6*d*. net.

problems for themselves. Since much ecological research can be undertaken without heavy expenditure, in the healthy open air, and by both individual and team efforts, it offers the teacher an easier opportunity of developing in his students a real scientific outlook than do many other subjects. The spoon-feeding of facts for memorizing by the student may have some value; it cannot, however, train the faculties of observation, consideration, and experimental initiative essential in science.

It is difficult to know how best to arrange ecological work for students. This applies both to courses and to text-books. The arrangement in Mrs. Drabble's book is orthodox in outlining the "factors" first, but the sequence of the chapters in Part II is peculiar and does not seem to be based on any logical plan. The chapters themselves are, however, for the most part, extremely useful, accurate, and up-to-date accounts of plant-communities, or groups of such. The wording is concise and unambiguous, and could scarcely be bettered for those who are preparing for examinations up to about the London B.Sc. pass (general) standard. The examination standpoint is, perhaps, emphasized by the inclusion as an appendix of 45 "Test Questions." W. B. TURRILL.

Practical Plant Breeding.*—The extending importance of genetics, from the standpoints of both pure and applied science, is reflected in the increasing number of textbooks dealing with the subject as a whole or with some special aspect of it. Since genetics is an experimental science which commenced, as far as its modern development is concerned, with Mendel's work on garden peas, it is appropriate and desirable that all who are engaged professionally in horticulture, and all those amateurs who take their gardening seriously, should be acquainted with the general principles and practice of plant breeding. Not only does such knowledge add interest to the study of plants, but it may enable the horticulturist to make valuable discoveries, either by drawing the attention of geneticists to facts of observation or by actually experimenting by fully controlled methods himself. Genetics has, however, made such enormous advances during the past three decades and has developed such an extensive terminology that the horticulturist requires either some special training or at least careful guidance in the elements of the theories and methods to avoid bewilderment on the one hand or waste of time and energy on the other. Such a guidance is provided in Mr. Lawrence's admirable book recently published in a convenient format and at a reasonable price.

Lawrence lays special stress on the technique of genetics. Very wisely he emphasizes the necessity of preliminary studies made in order to understand the methods to be used. A full and clear account of methods of protection, emasculation, pollination,

* By W. J. C. Lawrence, F.L.S. George Allen & Unwin, Ltd., London, 1937. Pp. 155, figs. 34. Price 5*s*. 6*d*. net.

recording, harvesting, labelling, and scoring is given. The theoretical laws of inheritance are explained in simple terms, and a brief outline of the mechanism of inheritance includes an account of polyploidy. The importance to the horticulturist of the different kinds of sterility is illustrated by examples. The penultimate chapter, which considers the possibilities of improving garden plants, should be particularly stimulating to ambitious gardeners. The final chapter very briefly indicates some of the recent results standing to the credit of the plant breeder.

This book can be strongly recommended to all who wish to obtain the greatest amount of pleasure and instruction out of a garden. It should also prove extensively useful to students sitting for examinations in horticulture. W. B. TURRILL.

A Flora of Assam.*—Part 2 of Vol. 1 of this Flora, comprising the families *Linaceae* to *Moringaceae*, has now appeared. It is to be regretted that this part exhibits the same flaws pointed out in the review of Part 1 in K.B. 1935, 586. It seems that sufficient care and research have not been devoted to the work, as several species reported from Assam in available publications (the " Flora of British India " and the " Kew Bulletin ") have been omitted. It is essential that all the plants falling within the scope of the work should be included in such a territorial flora. It appears that the compilation has been carried out entirely in Assam and not revised at some botanical centre where a good herbarium and reference library are available. Reference to the Sibpur and, especially, to the Kew Herbaria would have obviated most of the omissions. It is to be hoped that the compilers will be permitted to overhaul their work at least at the Sibpur Herbarium before the next part is sent to the press; they can be assured of assistance at that institution, as well as at Kew. As it is, it is to be feared that users of the book may be misled in the identification of the species not to be found in its pages. There are typographical, as well as nomenclatural errors; e.g., *Hibiscus subdrifa* for *H. Sabdariffa*, *Murraya exotica* L. for *M. paniculata* Jack, and *Chikrassia* for *Chukrasia*. C. E. C. FISCHER.

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* By U. N. Kanjilal, P. C. Kanjilal, A. Das and C. Purkayastha. Vol. I (Pt. II). Published under the authority of the Government of Assam by the Prabasi Press, Calcutta, 1937. Pp. ii+202. Price 8 Rs.

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